March, 1957 TWO SHILLINGS & SIXPENCE

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

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MAR 28 1957
DETROIT

Oars bonded with 'MOULDRITE' *take the strain*

THE CRAFTSMEN who make oars know the importance of constructional strength. And they know that 'Mouldrite' adhesives are the best for the job. 'Mouldrite' resins are available to meet any water resistance and weathering requirement. A 'Mouldrite' resin glue-line is stronger than the wood it bonds.

For woodworking of all kinds—joinery, cabinet-making, plywood manufacture, veneering, wood-chip bonding—and for all types of laminates, there is a 'Mouldrite' resin exactly suited to your requirements.

'Mouldrite' is the registered trade mark for the thermosetting resins manufactured by Imperial Chemical Industries Limited.

Making oars at Ayling's. 'Mouldrite' U.F. syrup is used by E. Ayling & Sons of Putney for bonding the wood before the oars are shaped.

IMPERIAL CHEMICAL INDUSTRIES LIMITED · LONDON · S.W.1

ICI

Welcoming Ghana as an independent member of the Commonwealth*

To celebrate the occasion the streets of Accra will be decorated with these large Bextrene mouldings made exclusively for Benjamin Edgington Ltd., by B. T. Bennett of Harrow. A special formulation enables the mouldings to be successfully gold lacquered, both for embellishment and for climatic protection.

* *Ghana is the new name for the Gold Coast territory.*

BEXTRENE regd

TOUGHENED POLYSTYRENE SHEET

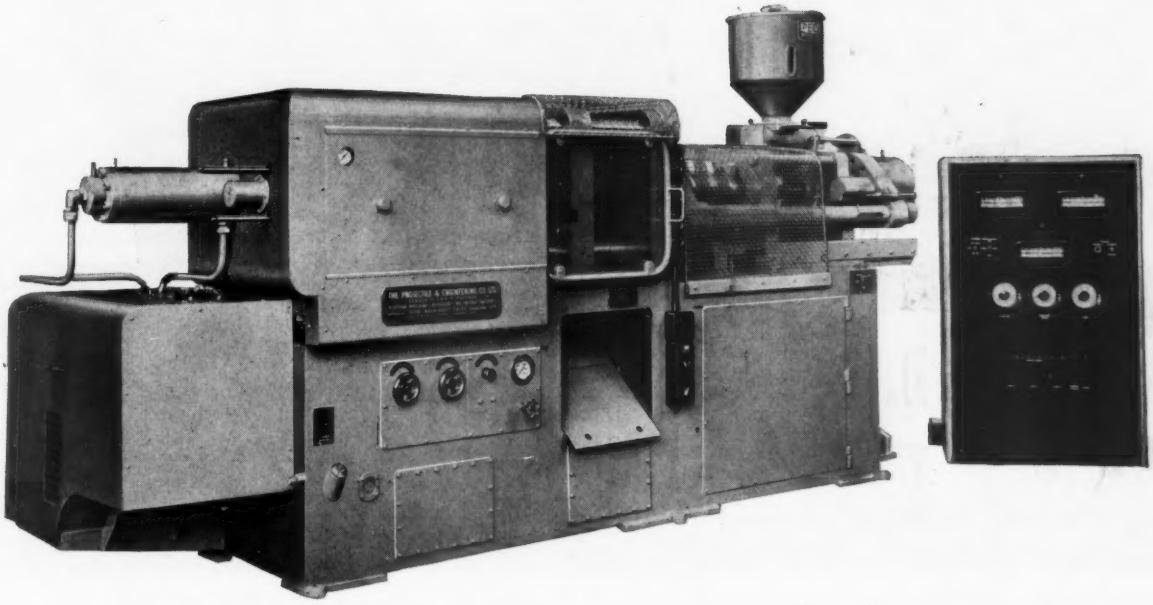
The display pieces are vacuum formed from .060 in. Bextrene Sheet in 4 sections. The body of the eagle is cemented with Bexol Solution and the wings attached by a special spring steel bracket allowing for compact packing when dismantled and limited movement by wind pressure when assembled.

BX PLASTICS LTD. *Higham Station Avenue, Chingford, London, E.4. Telephone: LARKSWOOD 5511*

A Subsidiary of The British Xylonite Company Limited

$\frac{1}{2}$ oz.—160 oz. capacity fitted with conventional or pre-plasticising injection units

Injection Moulding Machines



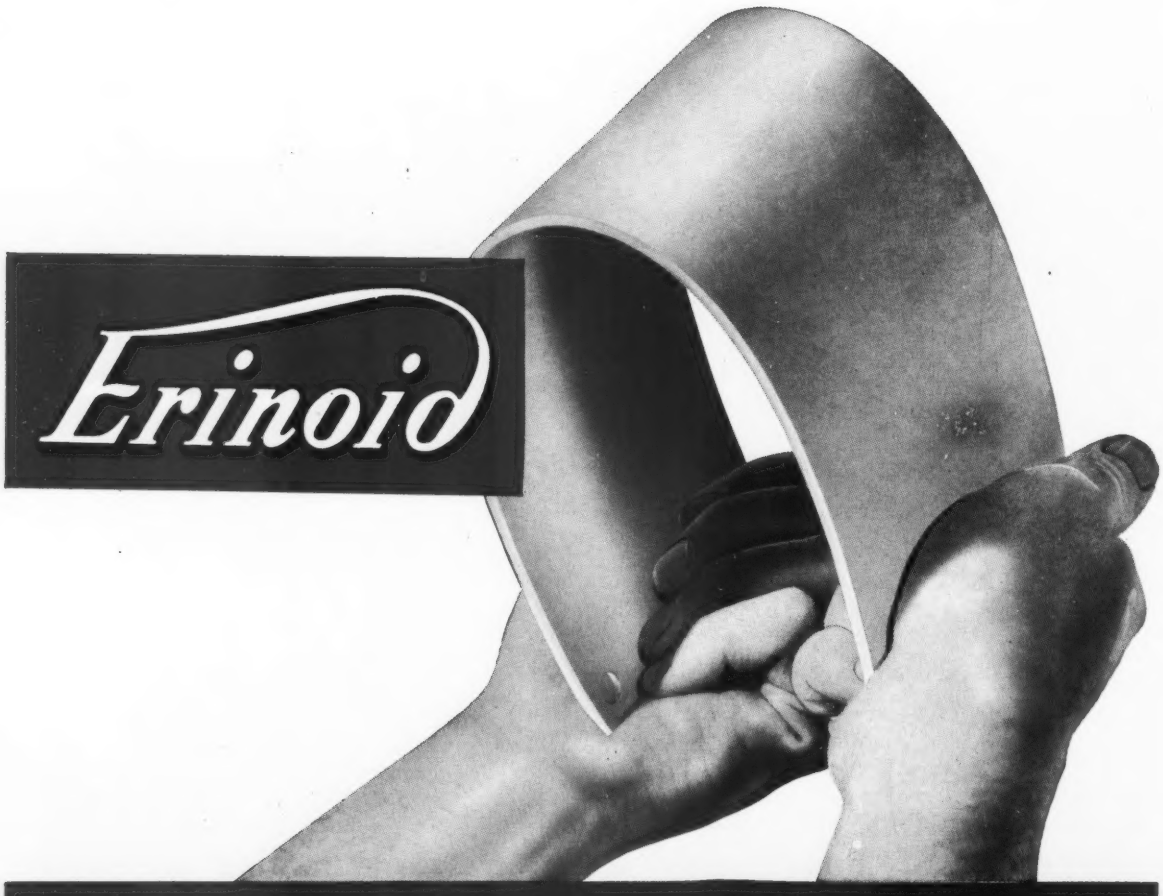
PECO PRODUCTS

PECO MACHINERY SALES (Westminster) LTD.

28, Victoria Street, London, S.W.1 Telephone: Abbey 1793/4/5

Telegrams: Profectus, Sowest, London. Cables: Pecomatic Sowest, London.

WORKS: THE PROJECTILE & ENGINEERING CO., LTD.



CP.20 grades

CP.20 GRADE polystyrene has a high impact and flexural strength; it exhibits a high elongation coupled with good tensile strength. CP.20 is easily processed by injection moulding, giving a high rate of production with a very high-quality surface finish. This material does not delaminate or crack during bending and its toughness makes it admirably suited to the production of articles such as toys, brush stocks, cleaner components, ball point pen barrels and radio cabinets. A complete range of translucent and opaque colours is available.

CP.20/HS GRADE has similar properties and strength characteristics to CP.20 grade but its softening point is approximately 100°C. and, therefore, resists continuous temperatures up to 85°C. This material is ideal for mouldings which have to be regularly washed in hot water. It can also be used for electrical appliances such as electric razor bodies, motor car components, and kitchen mixers, where the combination of toughness, excellent electrical properties, high heat resistance and the ability to mould in metal inserts makes it eminently suitable.

CP.20X GRADE has been specially designed for sheet extrusion. It has excellent impact, tensile, elongation and flexural strength.

CP.20X sheet requires shorter heating cycles than other types of high impact polystyrene. Matt and high gloss laminate finishes are available, in standard and specially matched colours.

Sheet sizes available

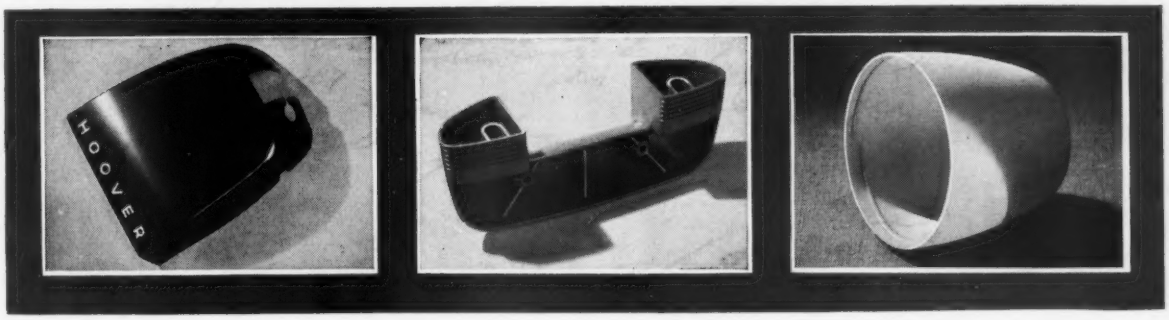
Dimension	Matt/Matt Finish	High Gloss Laminate Polish/Matt Finish
Length	Up to 96 in. max.	Up to 96 in. max.
Width	Up to 60 in. max.	Up to 40 in. max.
Thickness range	0.010 in.—0.190 in.	0.040 in.—0.190 in.

High-impact polystyrene CP.20 grade, and its supplementary grades CP.20X, CP.20/HS and CP.20/HS/VC, provide the ideal balance of impact strength, elongation and flexural strength, combined with heat resistance, excellent surface finish and mouldability. Many leading moulders are finding that, with these well-balanced properties, CP.20 grades are ideal materials for the manufacture of an extremely wide variety of articles, from refrigerator components to vacuum flask cups.

Vacuum cleaner motor cover moulded in Erinoid CP.20.

Car door arm rest in Erinoid CP.20/HS.

Vacuum flask cup in Erinoid CP.20/HS/VC.



Flexibility is the keynote of our service to customers. Our constant desire is to give the customer the grade most suitable for his product. An example of this is the availability of CP.20/HS/VC which we formulated specially to meet the demand for an ideal material for the production of vacuum flask cups.

Call in one of our Technical Sales representatives for a discussion—we can probably help you to find the solution to any moulding and moulding material problems that you may have.

ERINOID CP.20 grades are manufactured by

STYRENE PRODUCTS LIMITED

Full information, samples, prices, etc. on application to

ERINOID LIMITED • STROUD • GLOUCESTERSHIRE

Telephone: Stroud 810

LONDON OFFICE: 96 Piccadilly . London W1 . Telephone: GROsvenor 7111

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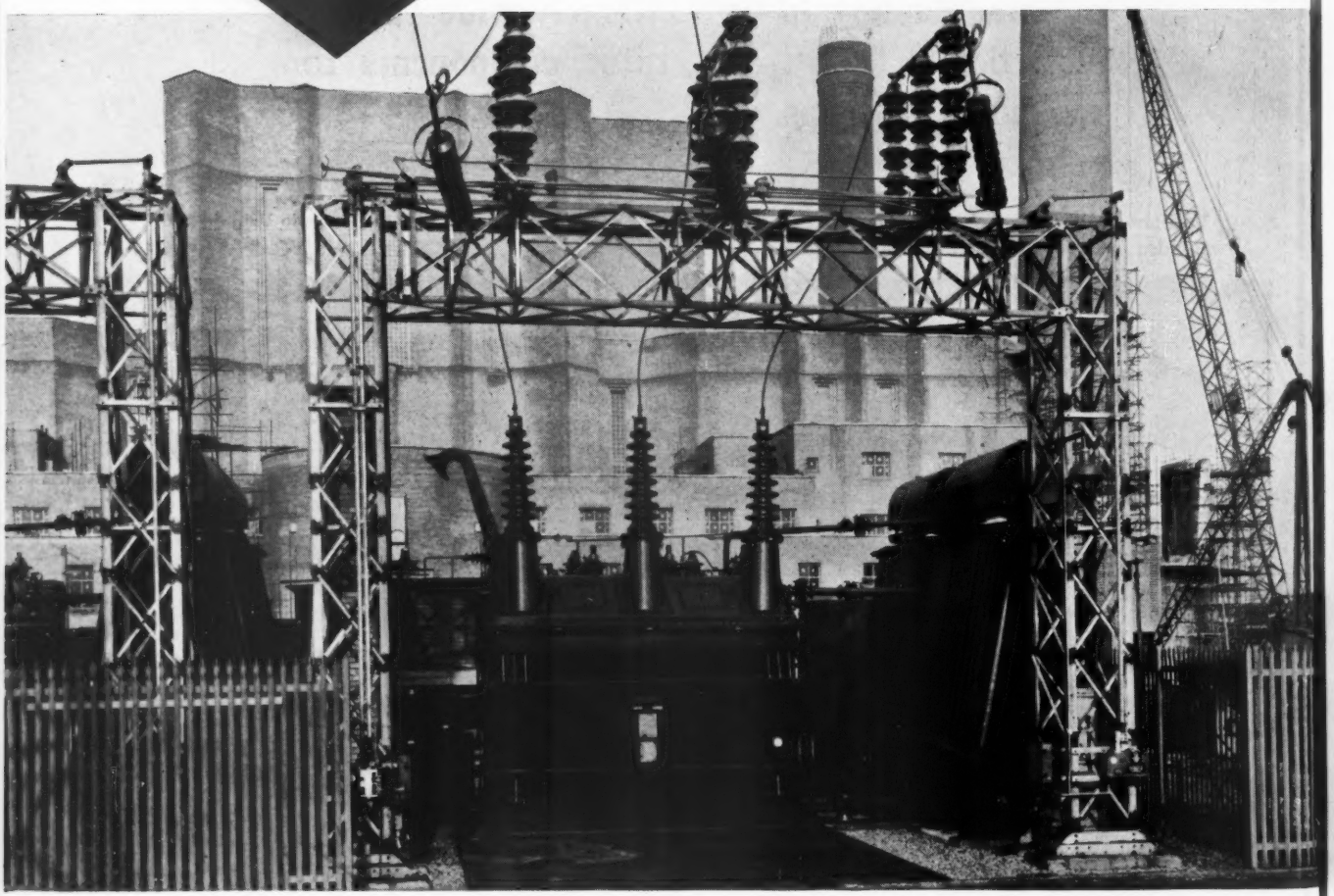
45 MILLION VOLT-AMPS KEPT AT BAY BY PAPER!

This is a 45 M.V.A. power transformer which feeds the grid at a large power station in Croydon. The vital insulators for the tremendous voltages involved are made entirely from *paper!* Paper—treated in a highly specialized way, turning it into a most necessary component of all power equipment. This is merely one of many instances where the latent strength and power of paper is harnessed to the needs of industry. For all such specialized uses, Tullis Russell, with nearly 150 years experience, are the people to know. They are at your service!



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BIRMINGHAM 177 CORPORATION STREET
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MANCHESTER 372 CORN EXCHANGE BUILDINGS, CORPORATION STREET

The Guy Warrior. All the red tinted area is moulded from structural plastics, using Beetle polyester resin. It cannot rust, it is corrosion resistant and stands up to the countless minor knocks and bruises of everyday use.

Nearside wing of the Guy Arab bus, moulded in structural plastics. This integrally stiffened wing stands up to very rough usage but could easily and cheaply be repaired without removal, in the event of damage.

THESE GUYS ARE TOUGH!

thanks to Structural Plastics

The Guy Arab bus. Grille, mudguards, bonnet and front panels are moulded in structural plastics. The bonnet is integrally stiffened; the hinge points and snap-action catch are integrally moulded.

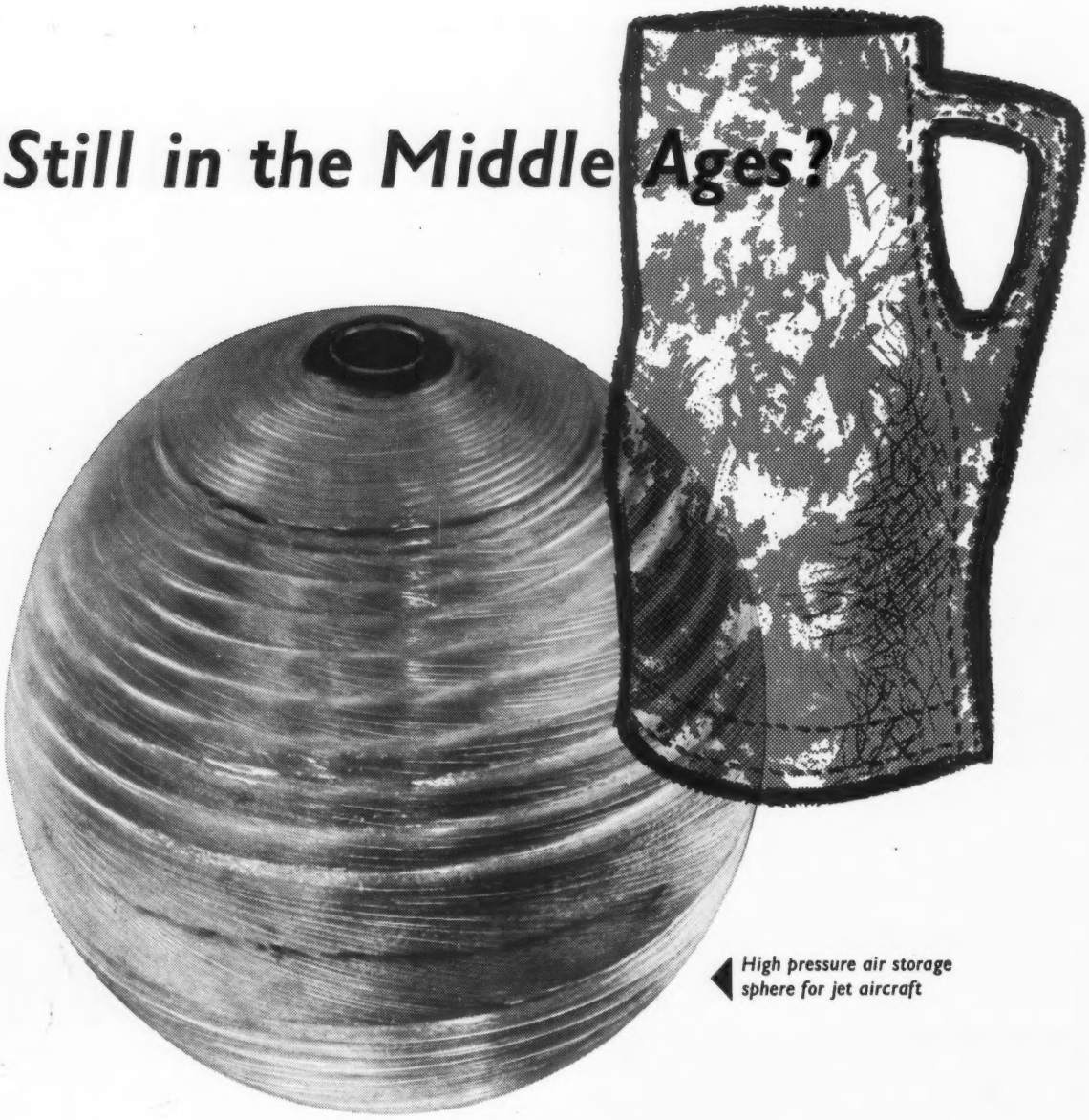
The confidence of the industry in structural plastics is amply demonstrated by their ever-increasing use. Guy Motors Ltd., for instance, send their ARAB buses and WARRIOR TRUCKS all over the world. With their many structural plastics bodywork components, they can be relied on to stand up to tough conditions and, if need be, can be repaired quickly and cheaply under almost primitive conditions. B.I.P. Chemicals Ltd., not only supplies Beetle—the highest quality polyester resin on the market—but offers unrivalled technical and training facilities.

BEETLE polyester resins B·I·P

B.I.P. CHEMICALS LTD. Oldbury, Birmingham *Telephone:* Broadwell 2061

LONDON OFFICE: 1, Argyll Street, W.1 *Telephone:* Gerrard 7971

Still in the Middle Ages?



High pressure air storage sphere for jet aircraft

Or laminating with Epikote Resins?

Epikote Resins, developed by Shell, have opened up new applications for glass-fibre laminates in many fields — tanks, piping, ducts, for instance — where hitherto the use of more conventional materials was the rule. These laminates have high tensile and flexural strengths, excellent fatigue resistance and an all-round chemical resistance. They are light and have a high degree of dimensional stability. Keep up-to-date on Epikote Resins for these and other developments.

SHELL

SHELL CHEMICAL COMPANY LIMITED, Marlborough House, 15/17 Great Marlborough Street, London, W.1.
Tel. GERrard 0666.

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..new applications..new ideas..take selling shape in

'Cellastine' TRADE MARK
Acetate Sheeting

for Vacuum forming

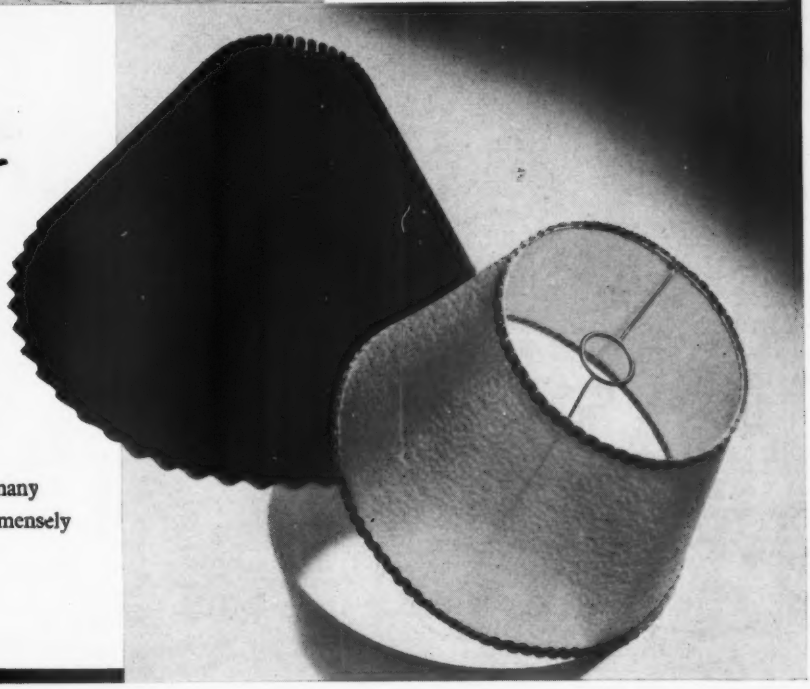
made by Boots Ltd.

This eye-catching brush and hand-cream display holder is typical of the sales-winning ability of vacuum formed 'Cellastine'. Note the effectiveness of colour and the beautifully finished appearance.

made by
E. & R. Jarvis Ltd.

Pleated or embossed

'Cellastine' throws new light on lampshade design with these strong, washable and colourful shades. They're proving so attractive and serviceable in so many homes — it's easy to see how immensely versatile 'Cellastine' can be !



BRITISH CELANESE LIMITED

Plastics Division, Celanese House, Hanover Square, London, W.1.

Dependable moulding

- Rapid action H.P.M. straight-line hydraulic mould clamp, quick interchange of moulds with automatic adjustment for thickness.
- Full ejecting pressure secured at any point of the return stroke. Increased daylight and stroke for producing deep parts.
- High speed injection unit increases plasticizing rate, and fast injection plunger speed reduces cycle times.
- Accurate compensating weigh feeders, and an extra timer permit double feeding of material for large capacity shots.
- Dual injection pump for two-speed injection or dual pressure injection, as desired.
- Silent pumps supply hydraulic power for maximum clamping pressure and operation of clamp and injection rams.
- All hydraulic components are readily accessible. A minimum of pipe lines permits easy interchange of valves without interference.

HPM

Model 800-H-48 48/64 oz

at lower cost per shot

Step up production with H.P.M. machines — the fastest injection moulders producing thermo-plastic parts at lower cost per shot than any other machines of comparable size.

They are fully automatic "all-hydraulic" machines possessing many outstanding features providing faster cycle times, powerful clamping and easy set-up, accurate material feed and high plasticising capacity.

In addition, they are economical with labour, floor space and material, and are dependable too. The machines range in size to meet every moulding need, and each unit is backed by over seventy years' specialist service.

PLASTICS INJECTION MACHINES

SPECIFICATIONS

	Model 200-H-12	Model 400-H-20	Model 600-H-45
Volume moulded per shot (cu. ins.)	20	34	81
Weight moulded per shot (ozs.)	12	20	46
Approximate mould stroke feed (ins.)	16	18	24
Plasticising capacity (lbs./hour)	120	200	360
Rate of injection (lbs./second)	14	17.5	40
Size of die plates	20" x 20"	20" x 20"	32" x 32"
Space between tie bars	17" x 20"	21" x 17"	26" x 24"
Mould opening	20"	20"	32"
Mould closing	12"	18"	32"
Maximum	32"	38"	56"
Maximum daylight opening	24"	24"	32"
Minimum	12"	12"	24"
Minimum daylight opening	4"	6"	12"
Weight of machine (approx. cons.)	6000	9000	16000
Mould clamping pressure (tons)	100	150	250
Mould clamping area	100	150	250
Capacity	100	150	250
Power required for heating zones when plasticising (kW.)	21.6	31.4	51.4
Motor required	40 h.p. maximum	55 h.p. maximum	100 h.p. and 30 h.p. maximum
Shipping weight (approx. tons)	9.5	17.5	33.5
Overall floor space required	10' 6" x 5' 6"	12' 6" x 6' 6"	20' 3" x 7' 6"

Production capacities specified above are for general purpose thermo-plastics.

Details of other H.P.M. plastics injection machines on application.

Wickman

WICKMAN (MACHINE TOOLS) LIMITED

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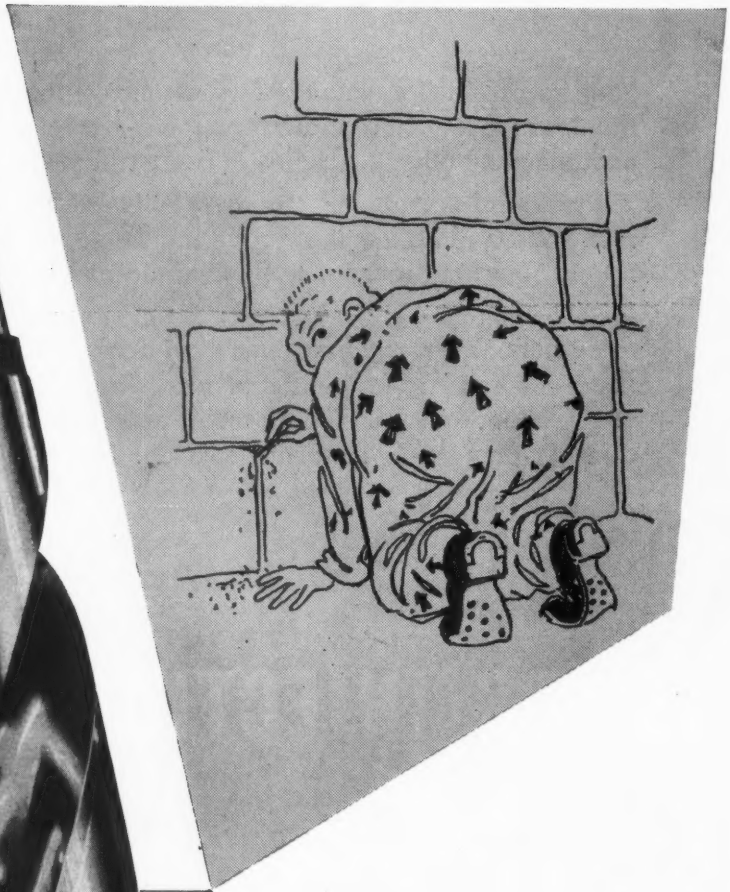

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with a

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HIGH SPEED STEEL
DRILL

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FIRTH BROWN TOOLS LTD

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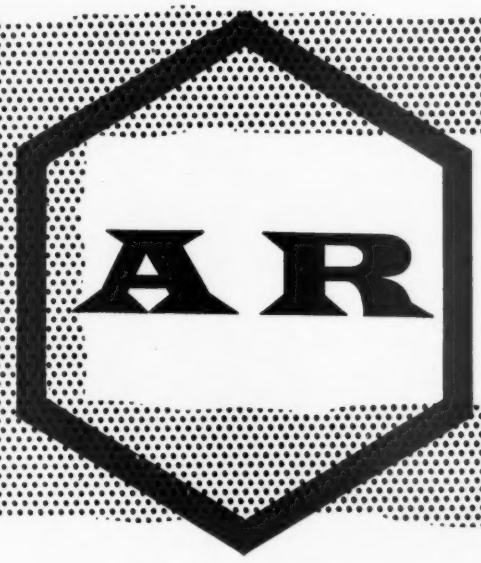
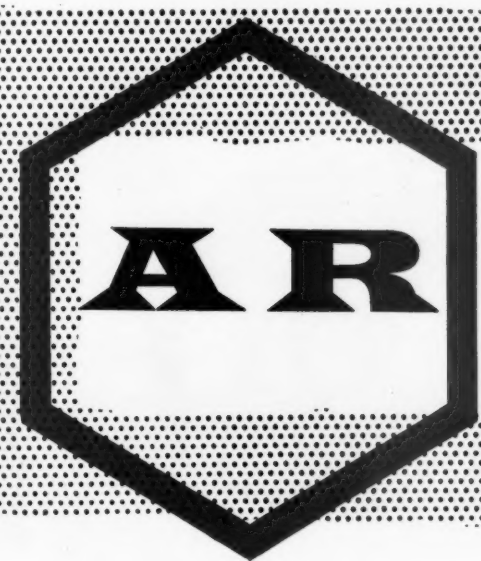
A new and comprehensive service for the REINFORCED PLASTIC MOULDER



POLYESTER COMPOUNDS . . . a separate compound for each technique and end use . . . fully formulated and proved for each specific application . . . ready for use with the sole addition of a hardener . . . pigmented in accordance with customers' requirements.

POLYESTER RESINS . . . a full range of specific grades . . . the right resin, at the lowest cost, for every individual application.



COMPLETE CONSULTANCY SERVICE covering . . . resin development · compound formulation · plant and product design · moulding techniques · prototype manufacture.

The right materials for every purpose — the right advice on every application

ARTRITE RESINS LIMITED *Kingsway Chambers, 44-46 Kingsway, London, W.C.2. HOLborn 3138*

Mechanical Applications of Paxolin*

Paxolin laminates, used for a multitude of electrical applications, are also widely employed for mechanical purposes. The material is half the weight of aluminium but tough and easily machined, and as it is supplied in a variety of grades the most exacting conditions can be met. Cams, drilling jigs, templates, and moulds can be fabricated from this versatile material as well as countless components for tools, clocks, instruments, and other devices. One special application is bearings. We have supplied not only small ones but some of massive proportions. We are also equipped for the production of very large moulded laminates such as door panels. Paxolin is well established in the mechanical as well as the electrical field.

* *PAXOLIN is a registered trade mark.*

m and i

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RISING COSTS *and* COMPETITIVE SELLING

* If you are planning new lines or find your profits are shrinking consult R. H. COLE for reclaimed plastics

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We also welcome your enquiries for the following imported products which are manufactured by associated companies in the U.S.A.:
SANTICIZER* 141 — non-toxic, fire-resistant plasticizer for P.V.C.
SANTICIZERS AND SANTOLITES* — speciality plasticizers and resins.
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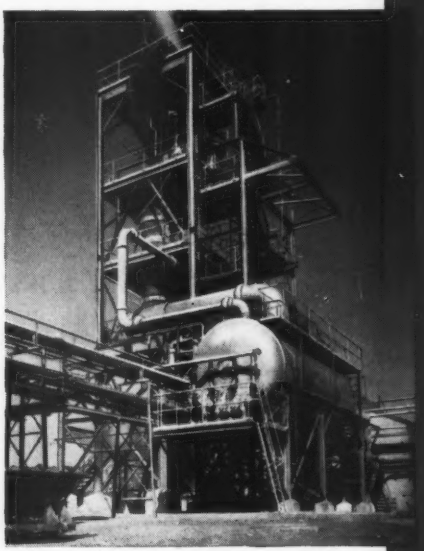

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.... a combined Achievement of Chemistry and Machine Building

In close cooperation with the Chemical Industry we have developed complete extrusion installations for the manufacture of plastic pipe, film, sheet, shape, filaments and others.

The technique of processing plastics on extrusion machines is gaining in importance every day. In this particular field **REIFENHAEUSER** extruders and packaged extrusion plants have made a world-wide name for themselves.

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Crystal Clear, Opal, and Opaque Rigid P.V.C. Sheeting

Model Police Launch Vacuum-formed from **Vitrone** *Rigid Vinyl Sheeting reproduced by courtesy of Sebel Products Ltd.*

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for the plastic fabricator with something special in mind

DEEPER DRAWING—BETTER DEFINITION
DIMENSIONAL STABILITY TO LIGHT OR HUMIDITY
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Manufacturers also of glass-clear flexible sheets, embossed sheeting, soft and rigid extrusions, etc.

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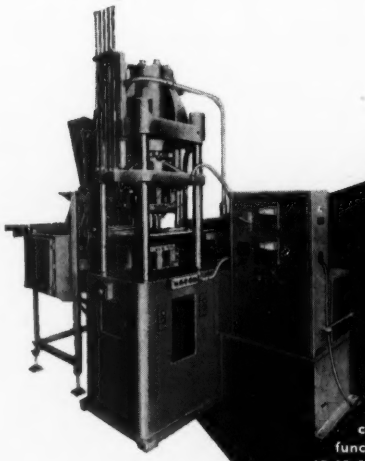

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AUTOMATIC
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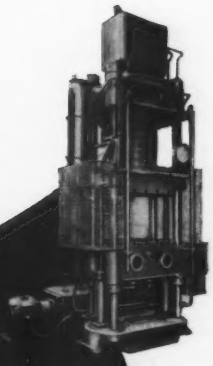
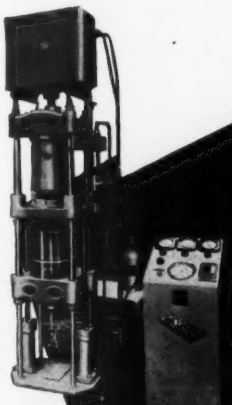
The complete answer to high production at low cost. A trouble-free machine with speed and versatility of operation which automatically and efficiently performs every known function in automatic moulding.
15, 25, 50, 75 and 100 ton range offers complete flexibility and covers every job – big or small.



150/200 DOWNSTROKING
PREFILLING HYDRAULIC PRESS

Completely self-contained with semi-automatic operation. Platen areas are 24" x 24" with a Daylight of 20". The Press is capable of approach speeds up to 3" per second and has a Greer-Mercier Hydro-pneumatic Accumulator incorporated in the circuit providing a highly economical power system with necessary high volume for fast cycling.

efficient plastic moulding



50 TON DOWNSTROKING
PREFILLING
SEMI-AUTOMATIC PRESS

For plastic Moulding complete with pump and Greer-Mercier Hydro-pneumatic Accumulator. The Press is semi-automatic in operation and is capable of extremely fast cycling having approach speeds up to 3" per second. A feature of the unit is the economical hydraulic power system in which a hydro-pneumatic accumulator provides the necessary high volume for the fast cycling —a small single stage pump being used to keep the accumulator charged during the 'cure period'. Platen areas are 14" x 14" between columns with a daylight of 18".

modern presses for increased production

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The Fawcett-Finney service co-ordinates the hydraulic engineering experience of Finney Presses Ltd. and Fawcett Preston & Co. Ltd. two companies conjointly covering every aspect of industrial hydraulics.

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"ELO" MOULDINGS for all classes of industry
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"ELO" RESINS for all Bonding, Laminating, Abrasive, and Friction material applications. Anti-Friction Resin for Fabric Bearings. Resins for Textile Paper Tubes and Bobbins. Cements, Laquers, Insulating Varnishes.

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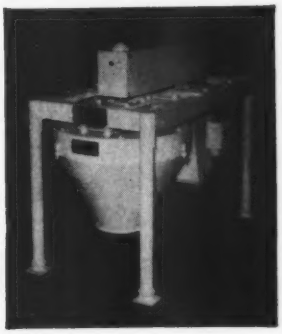

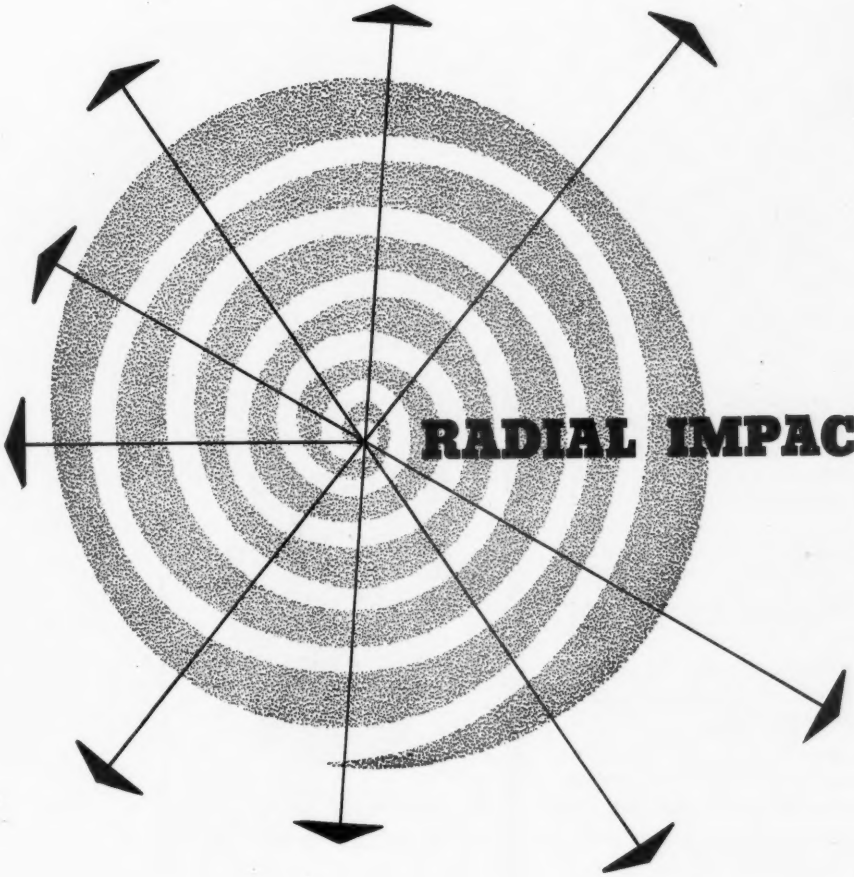

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the new way of grinding & pulverising

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The speed of rotation governs the degree of reduction and most powdered and granular materials can be ground accurately and without excessive temperature increase.

Capacities of the Entoleter Impact Mill range from 200 to 500 lbs per hour per h.p. and machines up to 40 h.p. are available.

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Polyvinyl Chloride · record scrap · flake resin · etc.

Tests willingly made on your own samples. Write today for details.

Entoleter Impact Mill by Henry Simon Ltd

SIMON ENGINEERING GROUP

STOCKPORT, ENGLAND

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Released from a sealed pressure charge, the finely ground powder bursts out in a fan-shaped cloud, smothering and blanketing the fire. The fine cloud also gives the fire fighter complete protection against the intense heat of a liquid fire, allowing him *to get within effective range of the blaze.*

DRAWBACKS HITHERTO ASSOCIATED WITH DRY POWDER PRINCIPLE NOW ELIMINATED

WE MAKE OUR OWN POWDER It is carefully prepared, ground, sieved, and mixed in our own £30,000 powder mill. Special treatment during manufacturing process avoids any chance of coagulation through static electricity.

No ingredients liable to bacteriological decay are used in its manufacture.

EFFICIENT EXTINGUISHER DESIGN Nu-Swift dry powder is held in sealed pressure charges—so it cannot cake, pack, or coagulate because of humidity.

Only negligible maintenance is necessary: inspection is simple—the tell-tale gauge on the container indicates whether the charge is unused and under pressure.

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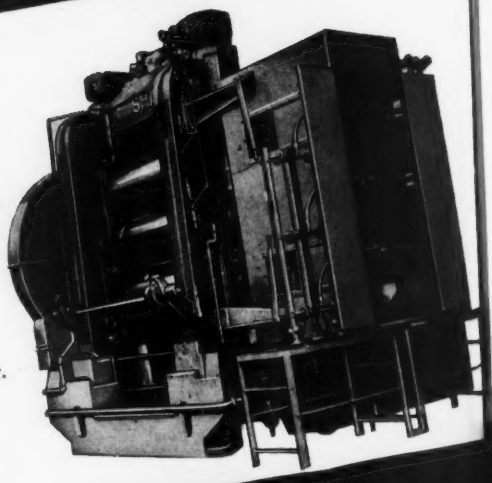

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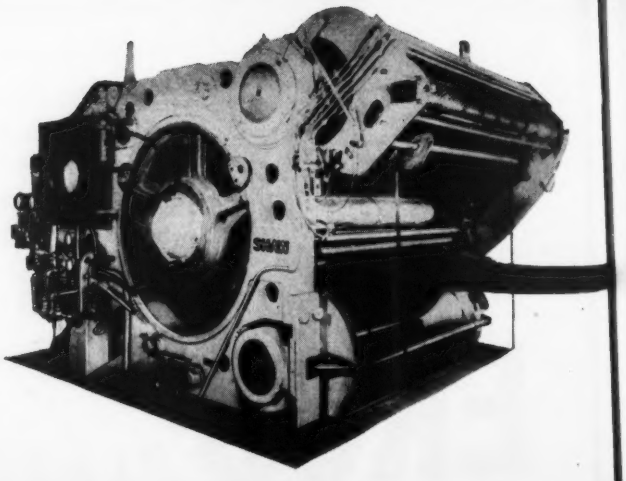

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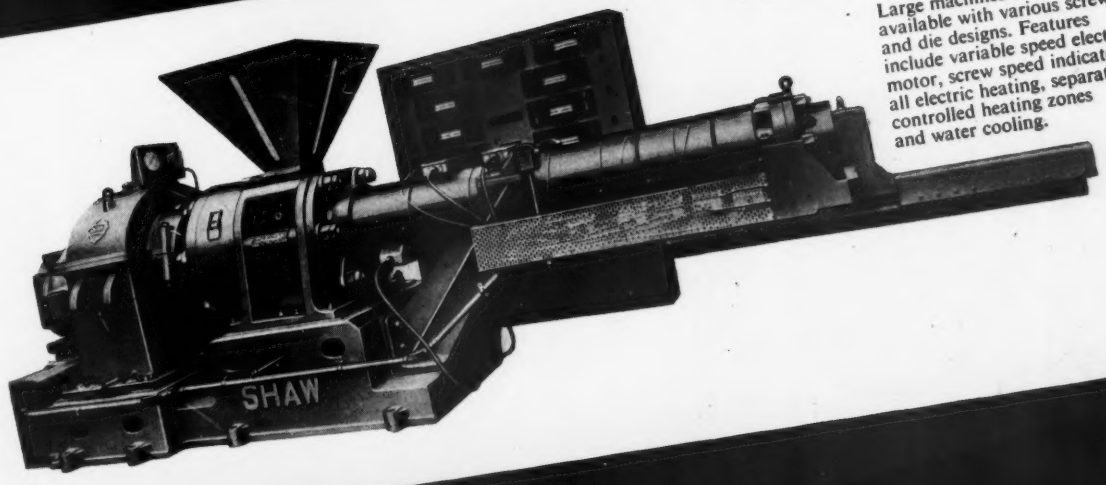

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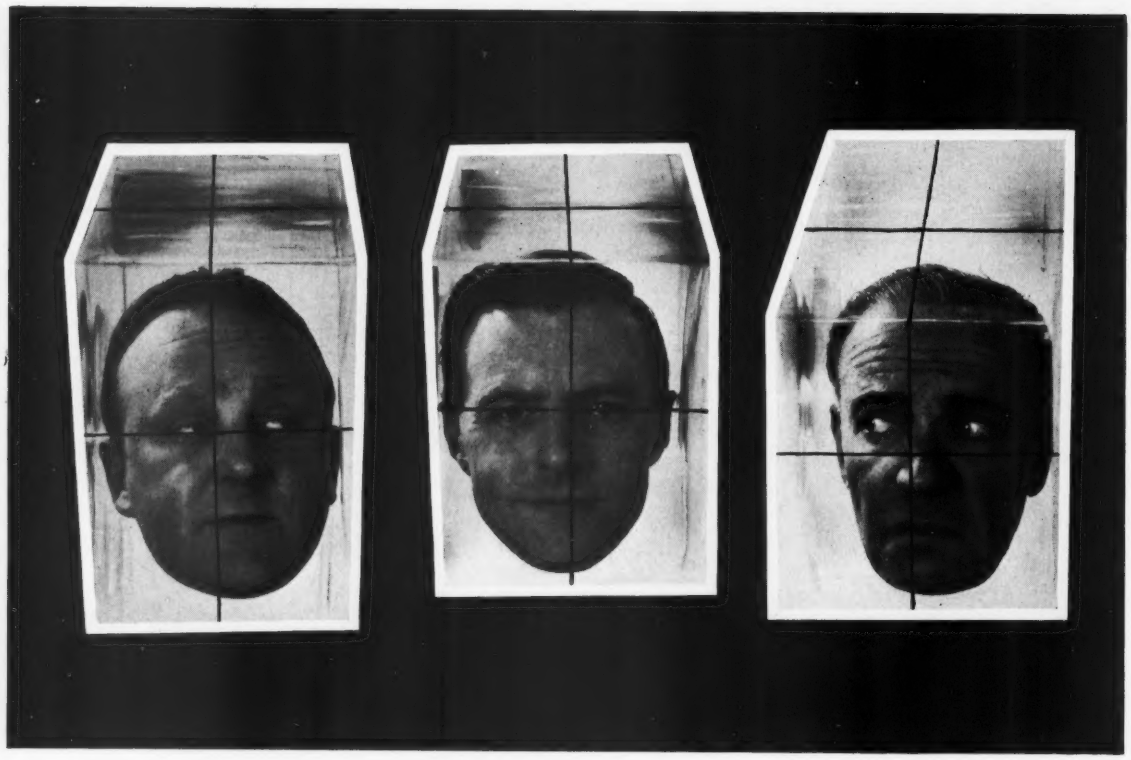

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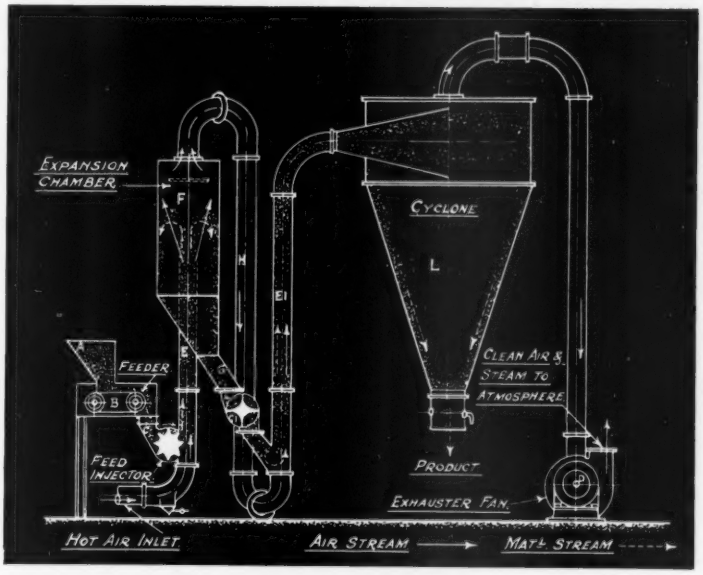
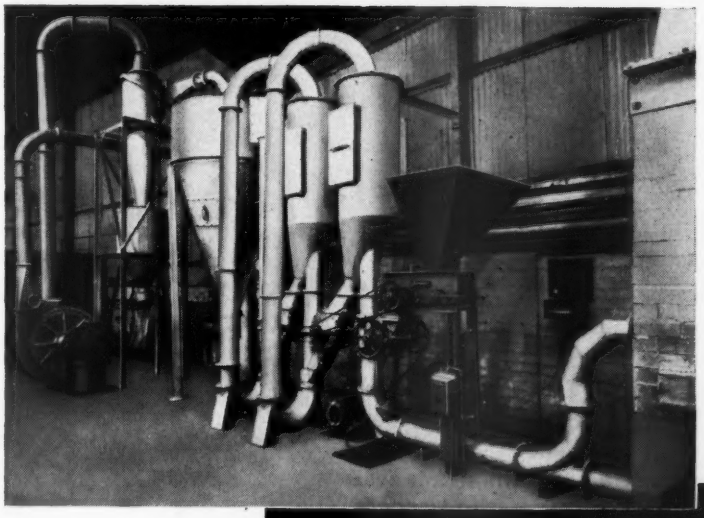
sawdust dances in HOT AIR STREAM





For drying sawdust and other filler ingredients for plastics, the British Rema Pneumatic Dryer is quick and effective and takes up relatively little space.

At all times during the drying the particles are separated and swept by high-velocity hot gases; this gives an extremely rapid transfer of moisture from the material to the air stream—drying takes place in less than one minute and the material never has time to get too hot.

This system of pneumatic drying is also very suitable for any materials which are easily damaged by breakage or overheating—flaked materials, crystalline products, etc.

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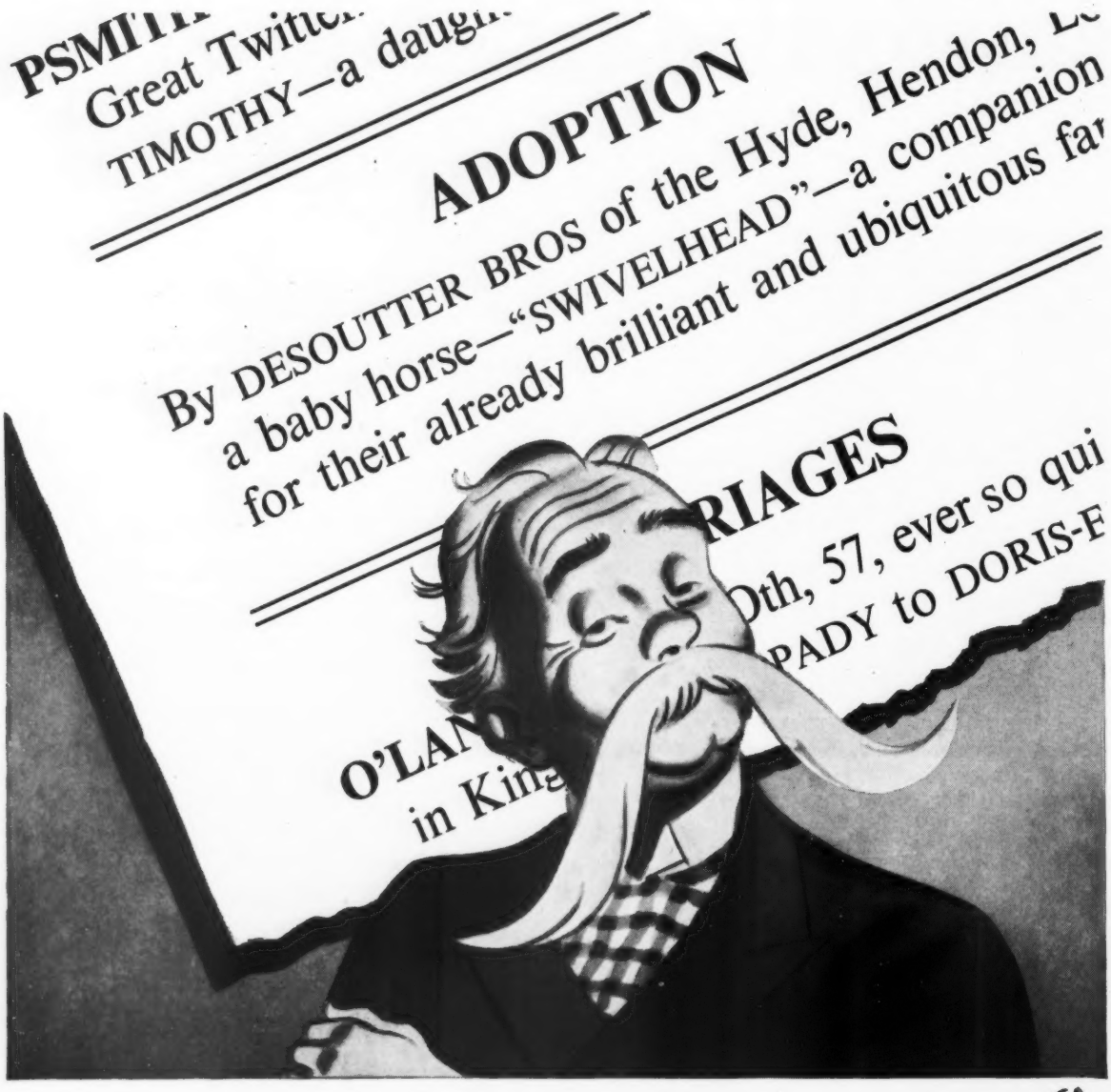

Little Swivelhead (officially known as the M70 Pneumatic Offset Drill) is the cutest, best-behaved baby horse you could wish for. His napper rotates full circle and can be locked in any position; he bites holes $^{3}/_{16}$" diam., revolves at 2,500 r.p.m., and gets in and out of tight corners without turning a fetlock. And now the little darling's all ours—all 24 ounces. We've adopted him from Vickers Armstrongs who dreamed him up with parts from two Desoutter M2 Drills. They brought him into the world for more awkward jobs on the Viscount *which no existing little horse could tackle*, and they deserve three hearty cheers! If you, Dear Reader, have such a brainchild, do introduce us, won't you? Better still, come and have a quiet chat with Uncle when he's just a twinkle in your eye.

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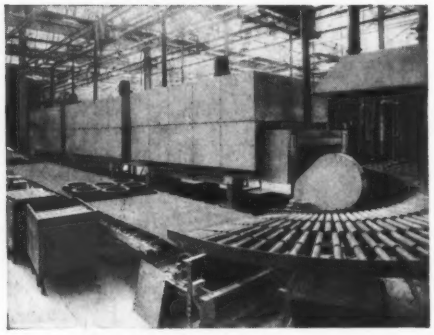

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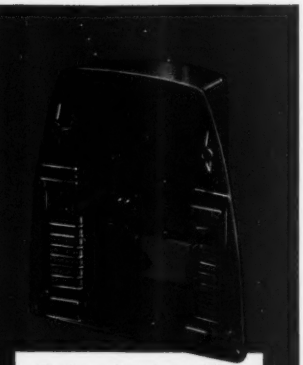
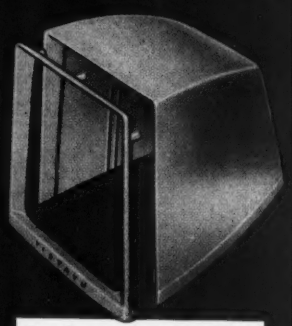
Large compression and injection mouldings

THE
VISTAVU
SLIDE VIEWER

is shown by courtesy of Rank Precision Industries Ltd. for whom the mouldings were produced.



The Base: Phenolic 'moulding of merit'. Area: 180 sq. in., weight: 26½ oz.



The Cover and Bezel: High-impact Polystyrene 'mouldings of merit'. Area: 280 sq. in., weight: 19 oz.

Machines of the largest capacity were required to mould the good-looking VISTAVU Slide Viewer. To ensure compression and injection mouldings of the highest quality, Insulators have set up separate organisations to carry out the two highly complex techniques involved. Compression mouldings are handled exclusively at Edmonton, and injection mouldings at Paddock Wood. Thus the skill and resources of each specialist group are channelled with powerful effect and economy to produce some of Britain's finest mouldings . . . at reasonable cost. 30 years of experience are at your disposal with every enquiry.

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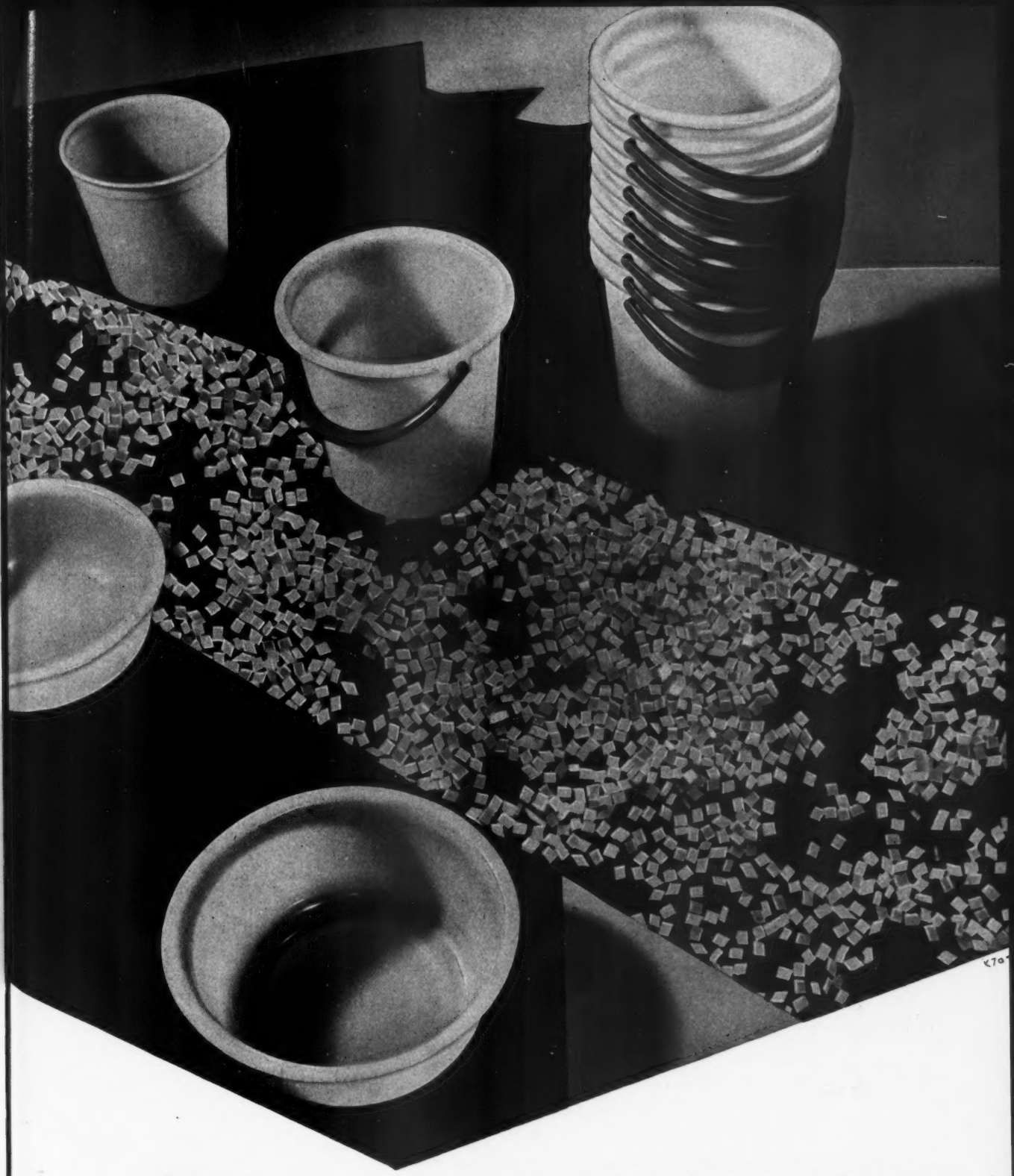

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Cadmium

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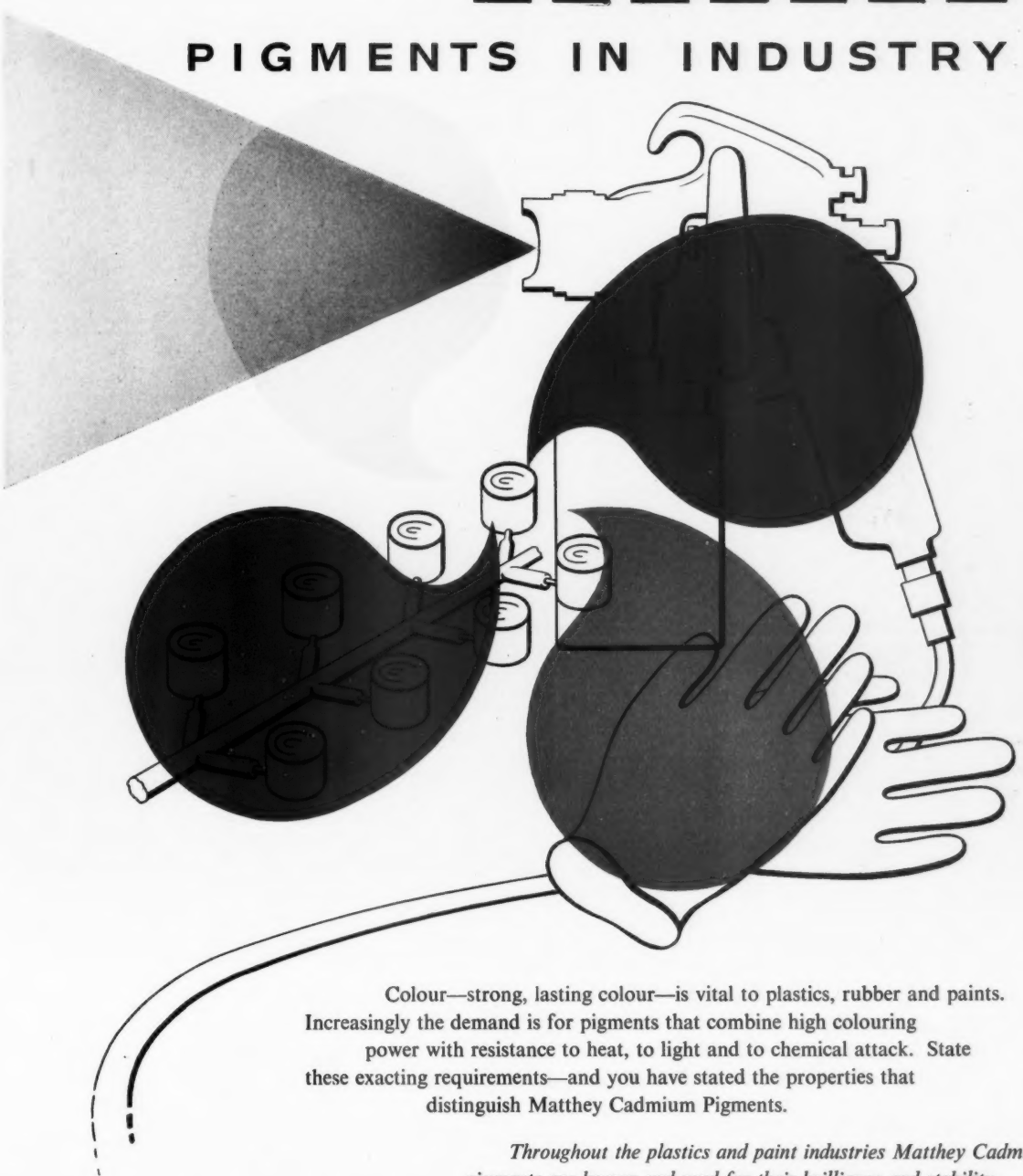

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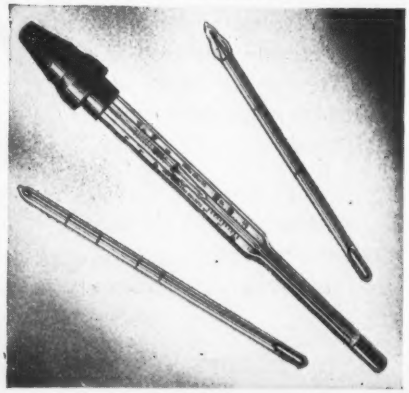

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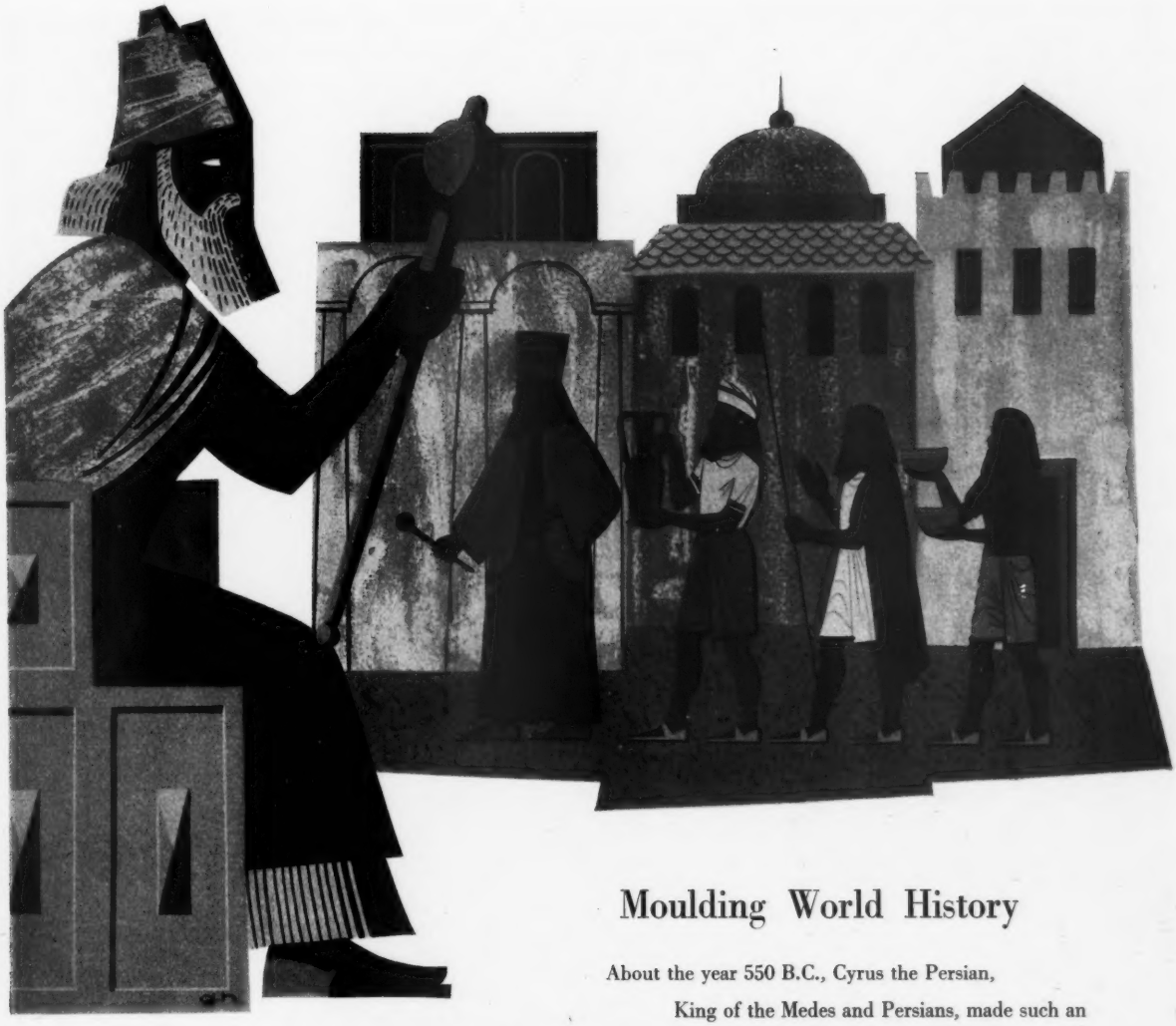

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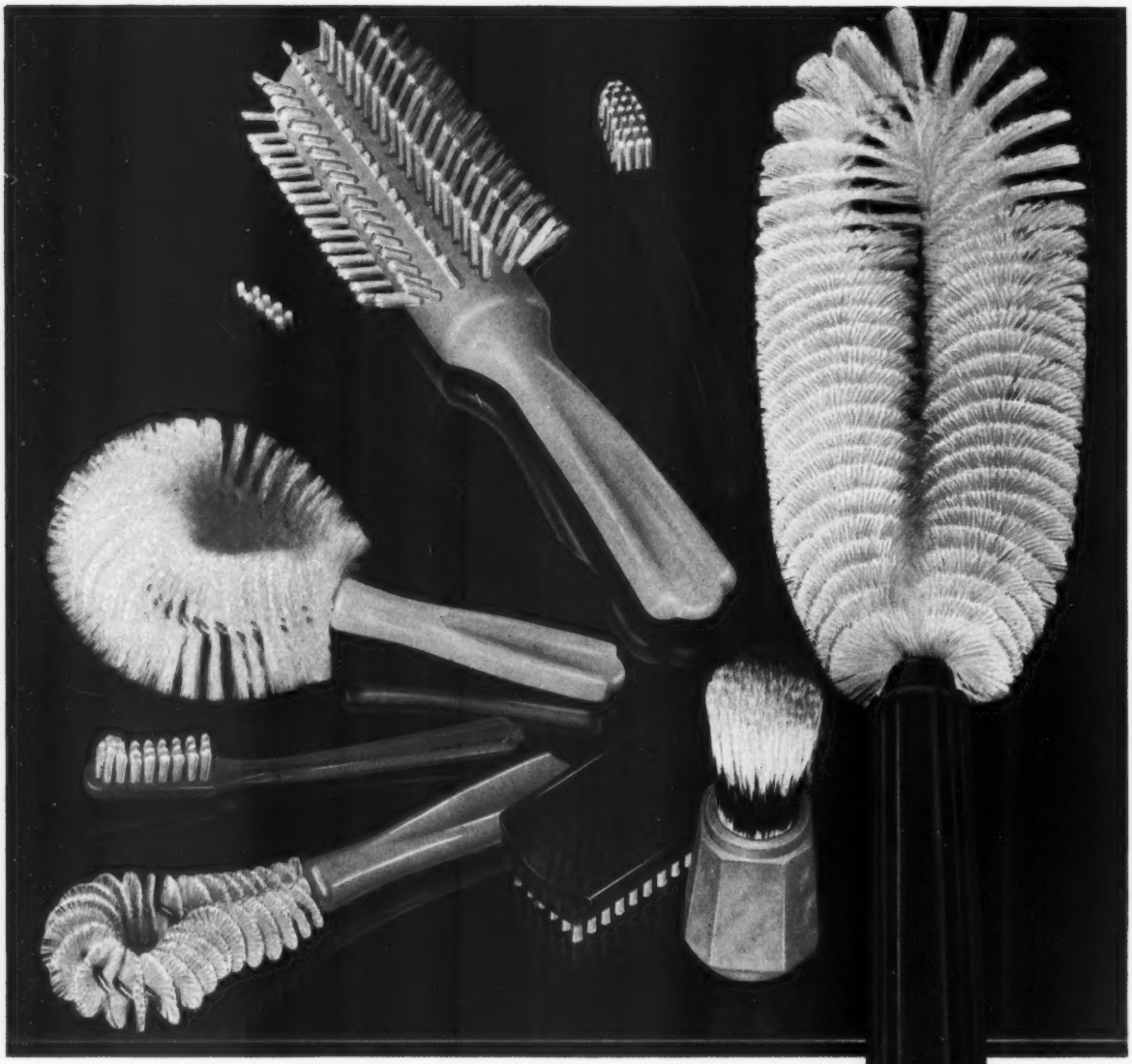

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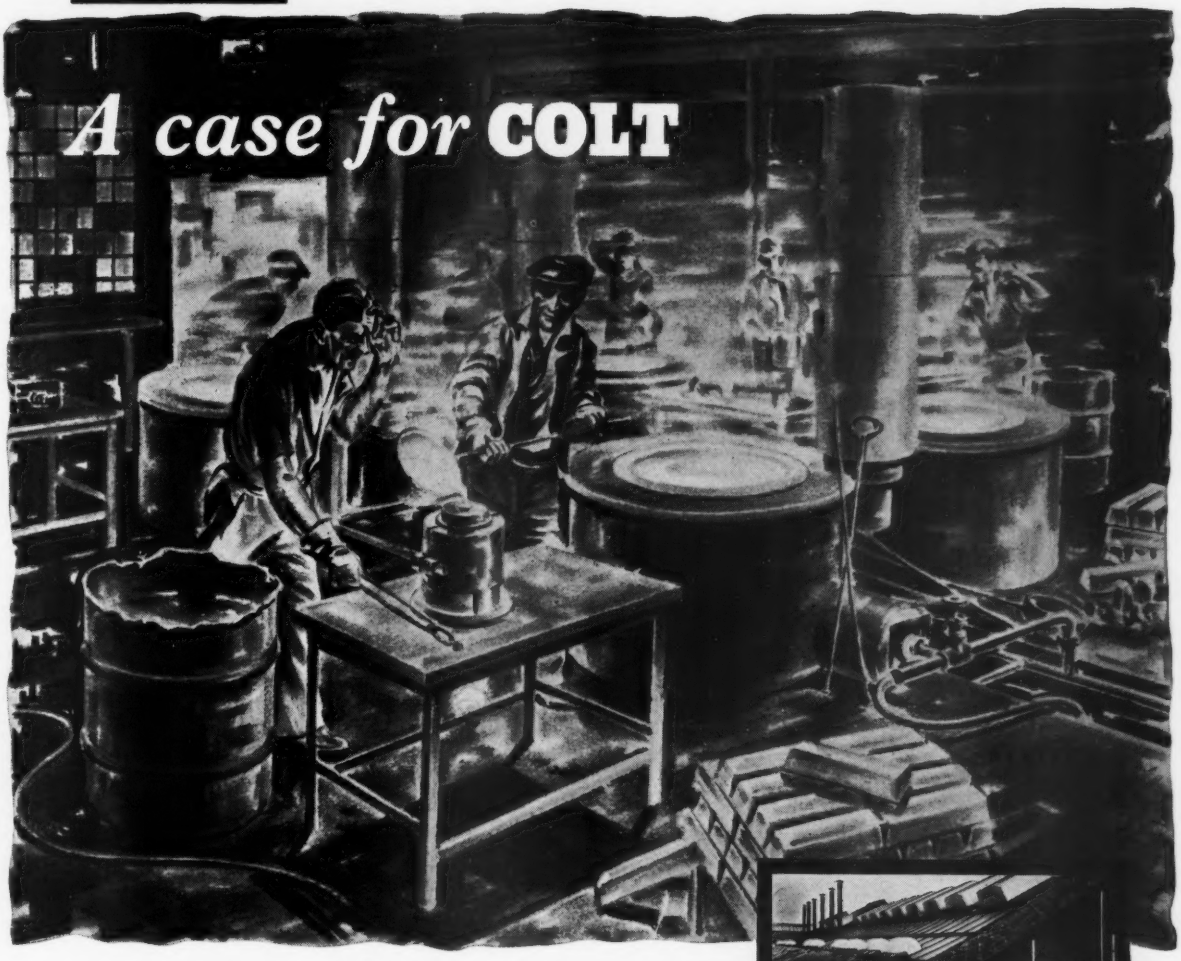
Problem No. 5 Intense process heat

A case for COLT



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For full details of Rockite Moulding Materials, write for Booklet No. 56

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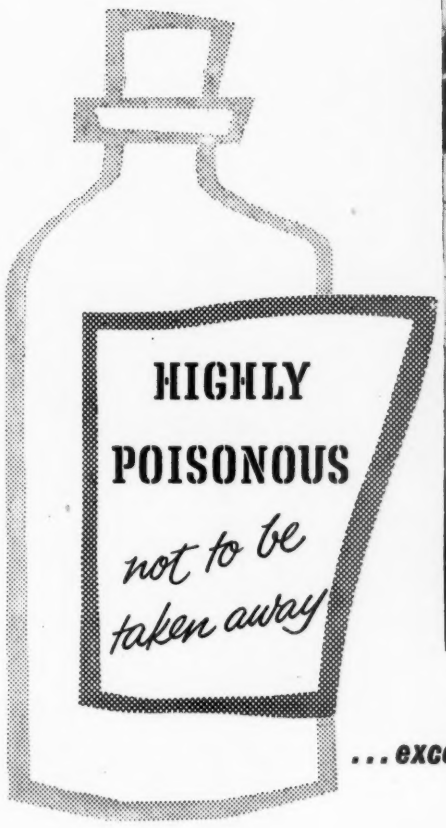
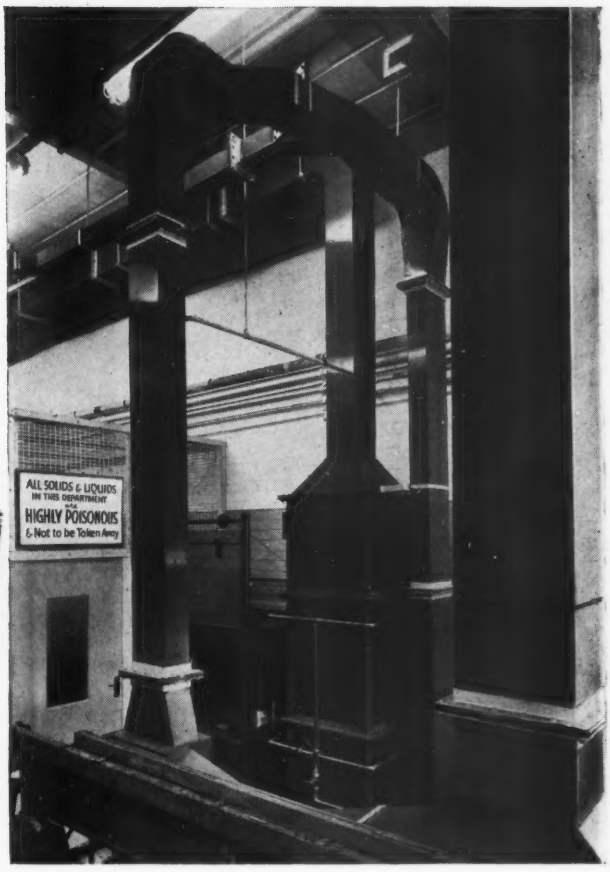
Sales and Technical Service: DEVONSHIRE HOUSE PICCADILLY LONDON W1 · TEL: MAYFAIR 8867

'Rockite' is a Reg'd trade name

ROCKITE

Absorption Towers and ducting
made with Cobex sheet
by Turner & Brown Ltd.,
and installed at the
Blackburn factory of Mullards Ltd.
Cobex rigid vinyl sheet
by BX Plastics Ltd.





... except in Absorption Towers made with rigid

GEON PVC

Specially designed for the elimination of corrosive acid fumes,
the "Turbro" Absorption Tower, with associated ducting,
is one of many important applications
for rigid Geon PVC in the chemical industry.
The advantages of this versatile material are clear—

Long Life
Rigid Geon PVC withstands attack by most chemicals.

Ease of construction
Rigid Geon PVC is dimensionally stable... lends itself to precision engineering. Tough rigid sheets are softened by heat, shaped on formers, cooled and joined by hot-air welding.

Maintenance reduced
As colours run right "through" the sheet, there is no need for painting or any other surface treatment.

For further information about Geon PVC please write for descriptive booklet No. 51

Geon
Polyvinyl Materials

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the ABSOLUTELY SAFE ELECTRIC CHAIN PULLEY BLOCK

- *Automatic, self-adjusting, disc-type Load Brake for double safety and accurate hook positioning.*
- *Cord or pendent push-button control.*
- *High Carbon Steel Calibrated Load Chain for absolutely safe flexibility. It is proof tested to twice safe working load.*
- *Patent Automatic Load Chain Guards and Limit Switches for complete protection against mishandling.*
- *Reversing T.P. Controller operated by pendent control from hoist, or remote control. Designed for heavy duty.*
- *All gears and shafts splined for strength and heavy duty bearings throughout.*
- *High torque motor totally enclosed.*
- *Precision ground alloy steel gears totally enclosed in oil bath gear box.*
- *Robust steel mainframe sustaining direct load.*

WRITE FOR BOOKLET P.B.31.

5 MODELS—

CAPACITIES 400 LBS. (lifting speed 37½ ft. per min.) TO 3,600 LBS. (lifting speed 3¾ ft. per min.). Alternative steel hook or trolley suspension.

Automatic Load Brake and independent Motor Brake provide double safeguard and accurate positioning of work.

PRICES FROM £73

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REGISTERED TRADE MARK

ELECTRIC PULLEY BLOCKS CRANES • CONVEYORS

OUR REPRESENTATIVE WILL CALL ON YOU —ANYWHERE IN THE WORLD

GEO. W. KING LTD., ARGYLE WORKS, STEVENAGE, HERTS.
TELEPHONE: STEVENAGE 440

for excellent dielectric properties...

Container Housing, manufactured by The General Electric Company Ltd., for one of their Switchgear Contactor units. Moulded in Beetle Alkyd BK 7082 (self-extinguishing grade).

high productivity

economy in tool costs

The rapid-cure properties of Beetle Alkyd Moulding Powders mean higher rates of production from existing tools. When ordering new tools, moulders therefore find that they can effect economies in cost and speed up deliveries of tools by reducing the number of impressions.

rapid cure

Mouldings made from Beetle Alkyd Moulding Powders, the latest addition to the Beetle range, are noteworthy for their electrical characteristics, especially arc resistance, low power factor and anti-tracking properties. They have good heat resisting properties, dimensional stability, chemical resistance and low water absorption. *Beetle Alkyd Moulding Powders pellet easily and can be moulded in ordinary compression and transfer presses; curing times are 25-30% less than for most u/f and phenolic moulding powders.*

BEETLE ALKYD
moulding powders B·I·P

B.I.P. CHEMICALS LTD. Oldbury, Birmingham. *Telephone:* Broadwell 2061
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E

I.C.I. SILICONES set the seal . . .

on U.K.A.E.A. testing

The United Kingdom Atomic Energy Authority were faced with an unusual problem when creep-testing some of their materials. How could they exclude the atmosphere, at test temperatures, in the region of the specimens, and still allow sensitive measurements to be made? Once again, I.C.I. silicone elastomers provided a solution. The Dunlop Rubber Company designed and produced a special extensometer seal of I.C.I. Silicone rubber which prevented the atmosphere entering the furnace tube in which the test specimens were shackled. The elasticity of the silicone rubber allowed sensitive measuring instruments to pass through the seal without restriction even though temperatures of up to 200°C were attained. This combination of elasticity and temperature resistance is an outstanding feature of I.C.I. silicone rubbers—one which can very likely solve a problem for you.

I.C.I. SILICONES

—material progress

For fullest information on all I.C.I. silicone products get in touch with:

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1.

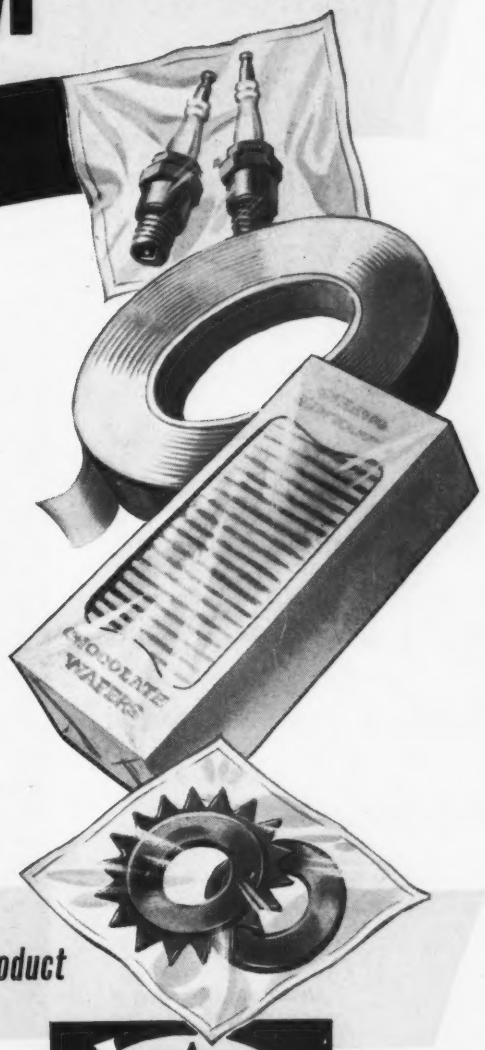
N.S.40

First time in Britain

CRAYTHERM *UNPLASTICISED*

Manufactured by the **Luvitherm** Process

P.V.C film



See Craytherm, the PVC that made news at the Packaging Exhibition. It's the very latest development in packaging film. Non-toxic, odourless, clear or coloured, and extra strong, Craytherm is the perfect protective pack for almost any kind of product. In thickness gauges from .001 upwards, Craytherm is manufactured by one of Britain's largest producers of vinyl film.

- ★ UNPLASTICISED
- ★ CHEMICALLY STABLE
- ★ NON-TOXIC
- ★ ODOURLESS
- ★ CLEAR OR COLOURED
- ★ EXTRA STRONG

CRAYTHERM *is made for YOUR product*

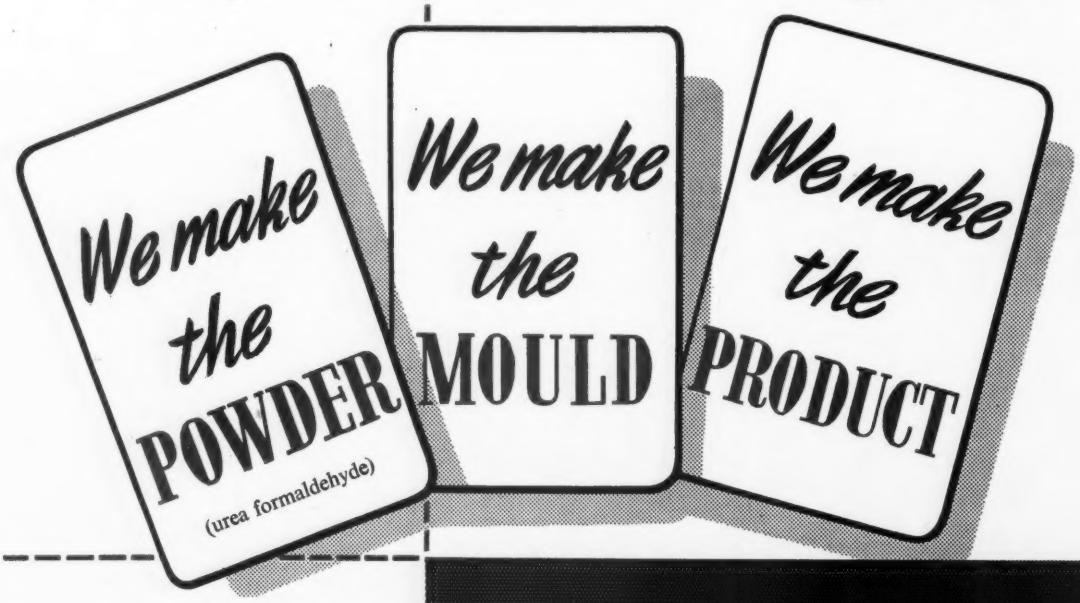
A Greenwich PRODUCT

GREENWICH PLASTICS LTD., St. Mary Cray, Kent, England
Telephone: Ravensbourne 4674/5 *and Orpington* 25671/2/3

Manufactured by one of Britain's largest producers of vinyl film

®

every trick in the game



We also provide the know-how to manufacturers wishing to benefit from our special skills and long experience.

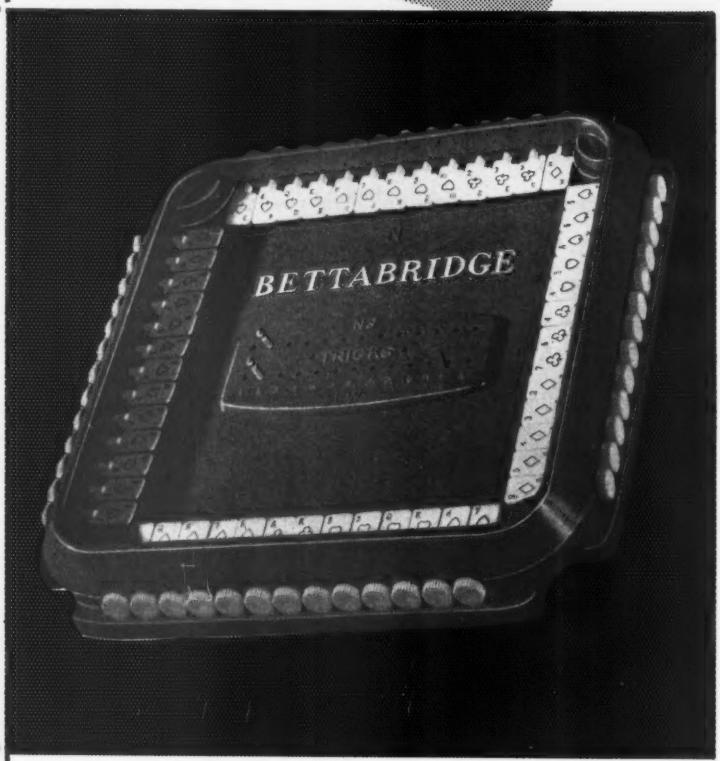


Illustration by courtesy of Ariel Productions Limited

LACRINOID
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LACRINOID PRODUCTS LTD · GIDEA PARK · ESSEX
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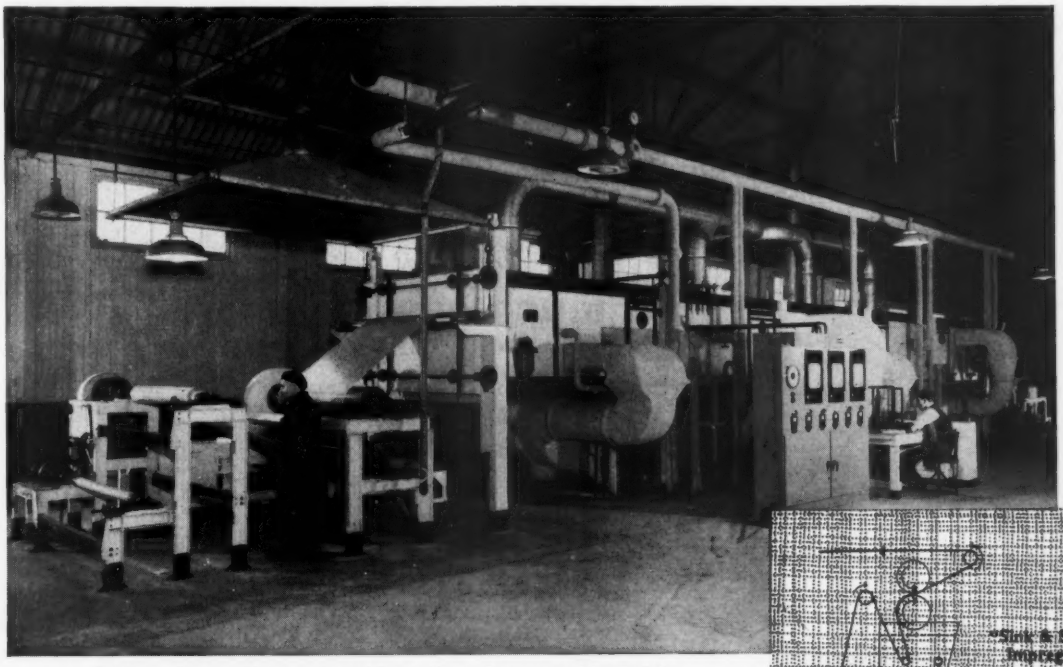
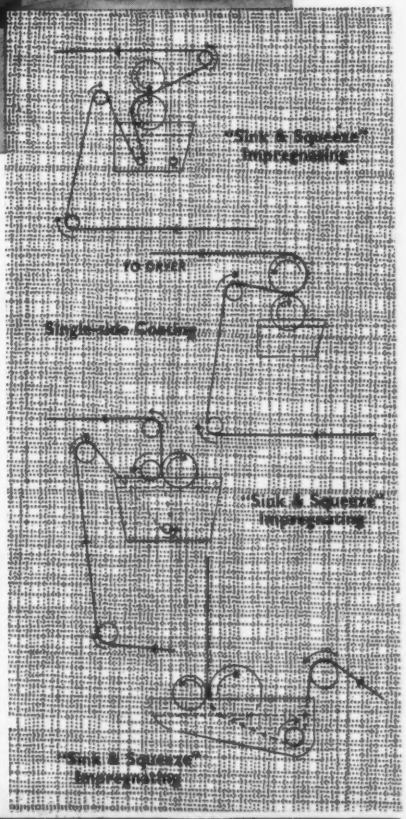
Mitchell IMPREGNATORS FOR THE PRODUCTION OF LAMINATES



Continuous Horizontal Impregnating and Stoving Plant. (By courtesy of Catalin Ltd.)



Mitchell modern continuous impregnators are supplied of the horizontal and vertical types for coating, impregnating and stoving papers and fabrics for the manufacture of laminated products.

Materials handled in Mitchell impregnators include:—

ASBESTOS for giving increased heat resistance.

PAPERS and FABRICS for decorative boards and electrical insulation.

GLASS FIBRE SHEETING for insulation.

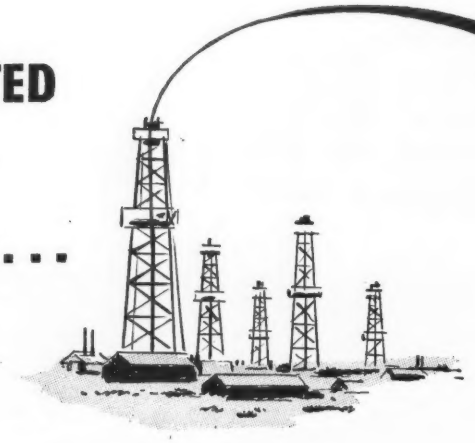
Our experience over many years in the Plastics industry is at your disposal. Plants designed to suit customers' specific requirements.

Inquiries invited for stoving ovens for resin coated components and parts —complete synthetic resin plants—fluid agitators and mixers—Sparkler horizontal-plate filters for clarifying and polishing resins, etc.

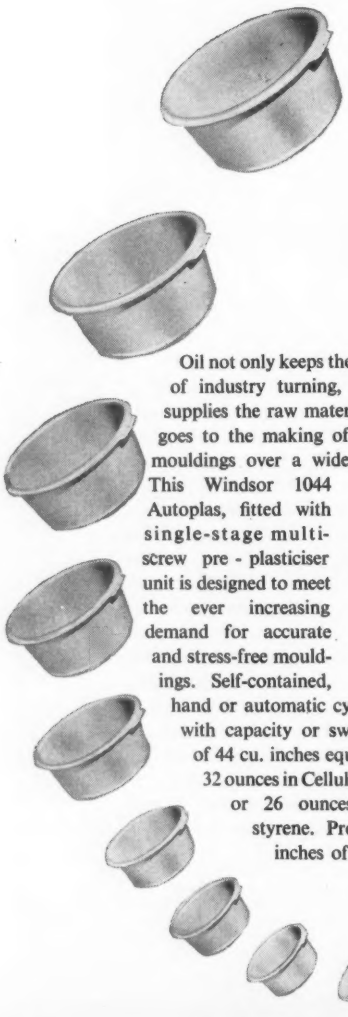
L. A. MITCHELL LIMITED, 37 PETER ST. MANCHESTER 2

M.D.6a

IT'S A COMPLICATED PROCESS FROM HERE . . .

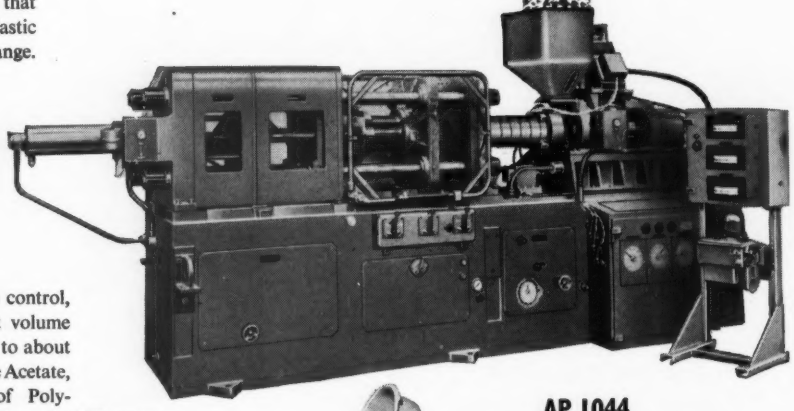


. . . TO HERE



-but much easier with a WINDSOR Injection Moulding machine

Oil not only keeps the wheels of industry turning, it also supplies the raw material that goes to the making of plastic mouldings over a wide range. This Windsor 1044 Autoplas, fitted with single-stage multi-screw pre-plasticiser unit is designed to meet the ever increasing demand for accurate and stress-free mouldings. Self-contained, hand or automatic cycle control, with capacity or swept volume of 44 cu. inches equal to about 32 ounces in Cellulose Acetate, or 26 ounces of Polystyrene. Provides up to 160 square inches of moulded area.



AP.1044
INJECTION MOULDING MACHINE

Descriptive literature on our full range of machines is available on request.

Windsor

Head Office and Works:
LEATHERHEAD ROAD, CHESSINGTON, SURREY
Phone: Epsom 5631 (PBX) *Grams:* WINPLAS, Chessington, Surrey
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PHENOL

A high-quality synthetic product meeting the most stringent requirements of the plastics industry.

XYLENOLS

A grade of refined cresylic acid of distillation range approximately 215-230°C. Total tar acid content 99.5 to 100%.

Availability:

Ample supplies for prompt delivery in road tank-wagons and in 40/45 gallon drums.

For further information, consult:

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

ICI

B.244

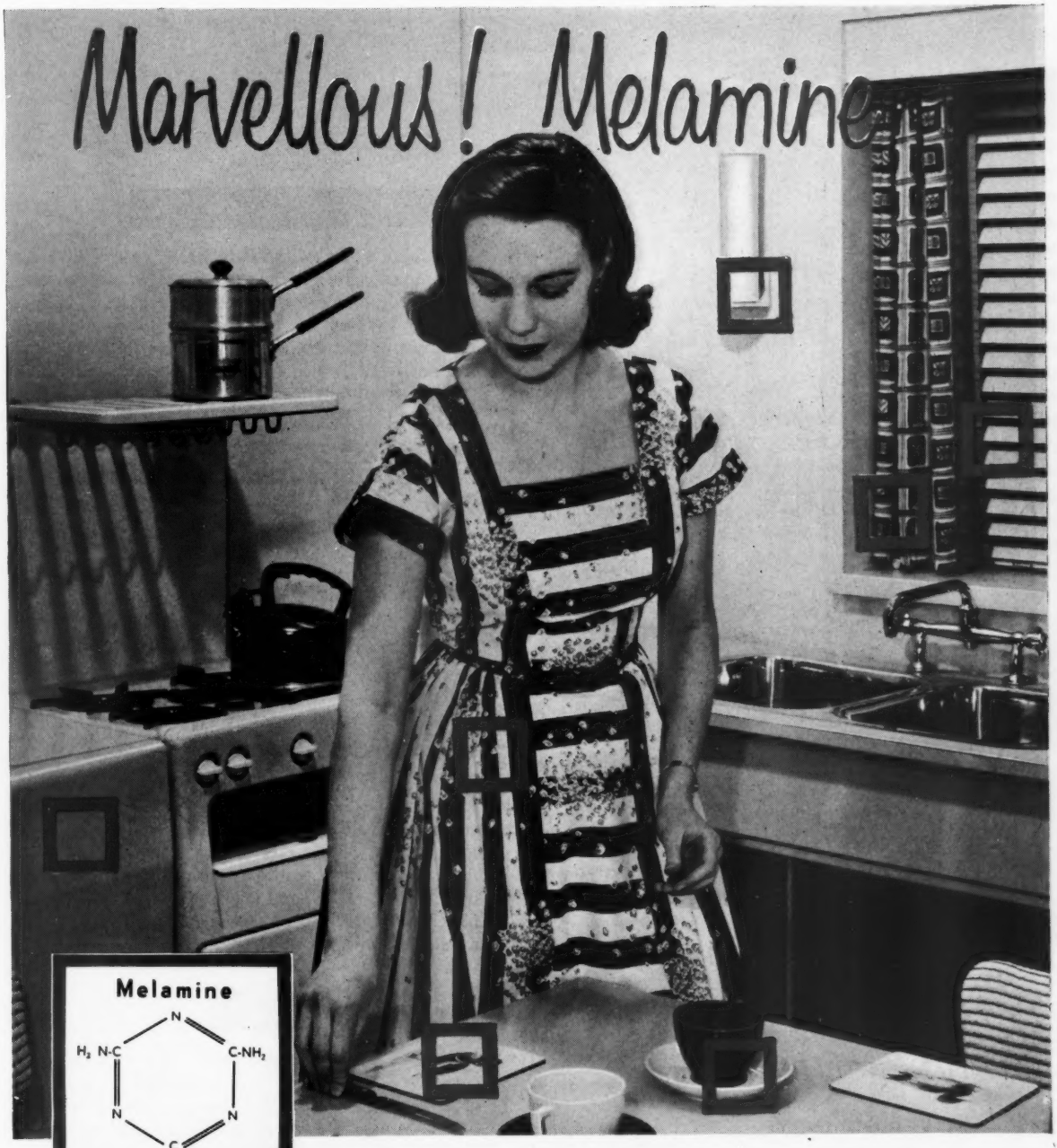
finished on a sound basis . . .

Finishing is but one of the various processes in the production of moulded plastics for industry.
For over 40 years the G.E.C. has been associated with all major developments in moulded plastics by compression and injection methods.
Mouldings are manufactured on a vast scale for use in household appliances, engineering, electrical insulating and electronic components.
Here is a service to industry in which you can have complete confidence. Whether the end product is a heavy duty junction box or a transparent food container, the G.E.C. can provide the best advice and service.

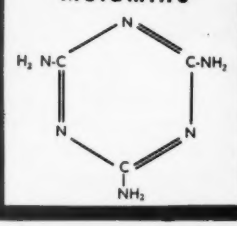
This phenolic radio cabinet is one of 2,500,000 mouldings produced by the G.E.C. every week in a wide range of thermoplastic and thermosetting materials.

moulded plastics for industry

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2



Melamine



Melamine is *everywhere* you look!

From fabrics to refrigerators—and that includes hundreds of things for the home—Melamine is making a big and distinctive contribution.

Marvellous Melamine is indispensable to many industries for quality products; for instance, Melamine moulding powders are extensively used for making the latest cups and saucers; Melamine resins are unrivalled for decorative laminates, industrial finishes . . . and they have unique properties in paper and textile finishing. The recent success in the production of flame resistant fabrics is an example here.

Marvellous Melamine is made by British Oxygen Chemicals; names of makers of Melamine moulding powders and resins will be given on request.

BRITISH OXYGEN CHEMICALS LIMITED

Vigo Lane, Chester-le-Street, Co. Durham. Tel: Birtley 145
London Office: Bridgewater House, St. James's, London, S.W.1. Tel: Whitehall 9777

F

Vinatex Limited

We specialise in the manufacture of P.V.C. Products. Consult our Technical Service Dept. for full particulars.

[redacted]

VINATEX P.V.C. COMPOUNDS are available for the production of general extrusions, for cable sheathings, for direct insulation, for injection mouldings and for the manufacture of calendered and press sheetings. All qualities are scientifically formulated from selected raw materials and can be supplied in pelleted or granular form.

[redacted]

VINATEX COLOUR CONCENTRATES are flexible P.V.C. Compounds in granular form containing a high proportion of pigment. They are especially manufactured for colouring natural VINATEX P.V.C. Compounds during extrusion. It is possible to manufacture extrusions in various colours from a basic natural compound, effectively reducing the range of stock compounds.

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VINATEX P.V.C. PASTES are dispersions of the resin in plasticisers with other components; they contain no volatile solvents. When heated they form solid shapes or films of great toughness and wear resistance. They are waterproof, unaffected by sunlight, ozone, alkalis and acids. Grades are available for the manufacture of coated fabrics and for slush moulding and dipping.

[redacted]

VINAGEL is our Trade Name for a new series of compounds based on Polyvinyl Chloride with the characteristics of putty for hand modelling and low pressure processing, or having the consistency of low viscosity pastes for cold dipping.

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VINAMOLD Hotmelt Compounds are flexible, mould-forming materials for use in the plaster, cement, concrete and resin casting industries.

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A Unit of Reichhold Chemicals Limited

VINATEX LIMITED, DEVONSHIRE ROAD, CARSHALTON, SURREY. *(Wallington 9282)* V.40

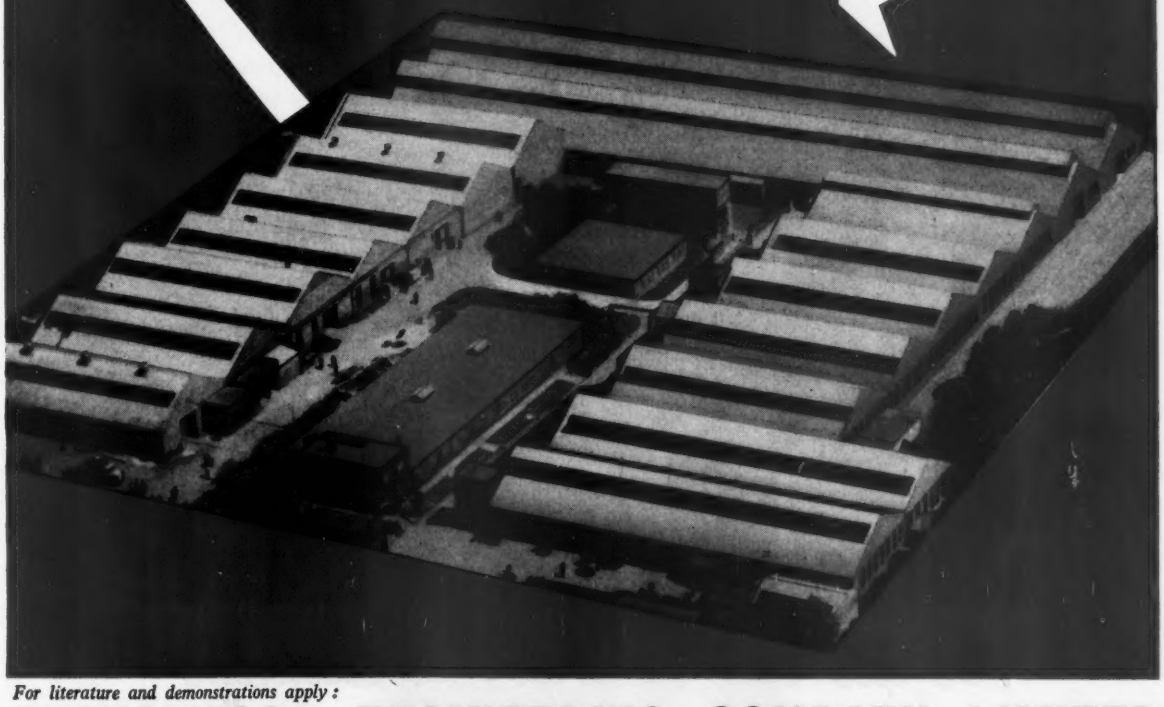
BURTONWOOD - ANDOUART EXTRUSION EQUIPMENT

is now being produced by

BURTONWOOD ENGINEERING CO. LTD.

All types of extrusion machinery for the Cable and Plastics Industry

Extruders · Pay-offs · Capstans · Take-ups · Dieing · Granulators · etc.



For literature and demonstrations apply:

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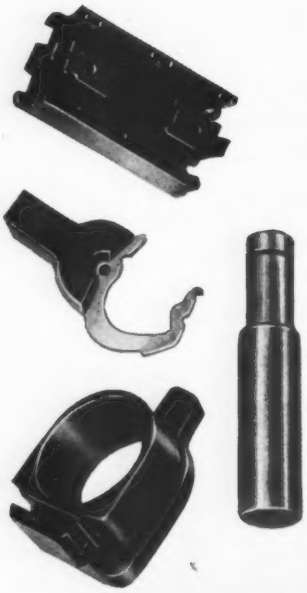
ROOTES

VARIETY IS THE SPICE OF LIFE



That's why we at ROOTES MOULDINGS find life so interesting. Our clients come to us with a diversity of problems to solve. It's right up our alley because we can supply the complete solution within our own organization.

We design mouldings, make the tools and our craftsmen, aided by the most up-to-date precision equipment, start production immediately.

The result—a first class job at a competitive price.

For all plastic moulding problems consult us now—we're confident we can help you.

ROOTES MOULDINGS LIMITED

For all compression mouldings

Contractors to M.O.S., Admiralty, etc. A.I.D. Approved

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[redacted]

knock at any door...?

The Pressed Steel Company Limited were looking fo
an attractive, functional easy-to-clean evaporator do
for their new Prestcold refrigerator.
It was our kind of job..... technicians and workmen
rolled up their sleeves—and here you see
the result, this high impact Polystyrene door.
Simple, streamlined, effective—altogether a pretty
good job. Leastways that's how our clients,
The Pressed Steel Company Limited feel about it—
and we at Rootes Plastics like to think so too.
No matter how big or small, if your problem is plastics bring it to the Rootes door—you won't even have to knock.

RE INJECTION MOULDINGS IN
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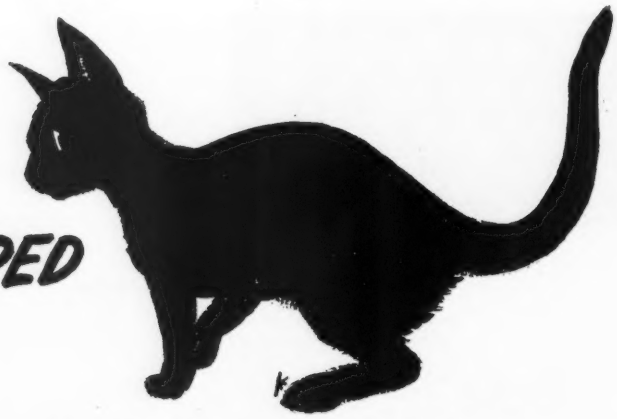
You can call this a FELINE QUADRUPED



20

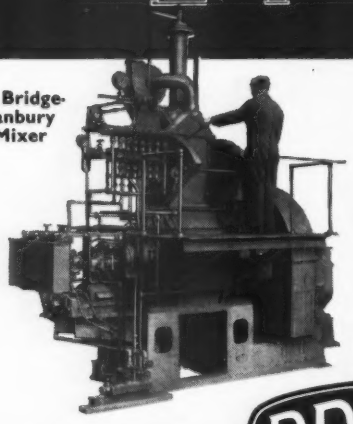
INSTALLATION AND OPERATI

many years, the company has made a specialty of engineering complete processing set-ups. Developed from start to finish by company engineers, each of these layouts is composed of production machines *matched* in capacity to prevent the "choking" or "starving" of succeeding units. Production flows without costly interruptions and with manual aid and supervision reduced to a minimum.

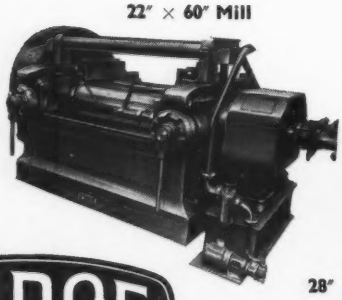
Where the mixer is located on a mezzanine directly above the sheeting mill, the mixed stock, when discharged, drops into the bite of the rolls and can be taken off in a continuous

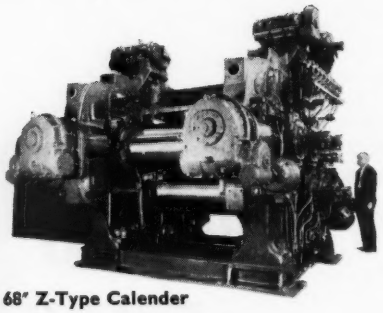
We know it as a cat. You can refer to a highly efficient continuous production method as "automation". We know it as a system which we have recommended and applied all along to our BRIDGE-BANBURY Matched Production Processing Units. On the left is a reproduction of a portion of our catalogue published a long time before the word "automation" became so popular. Proof indeed that what is now hailed as the ultimate in efficiency has in fact been available to BRIDGE-BANBURY users for years. Below is a schematic layout showing controlled automotive

3A Bridge-Banbury Mixer



22″ × 60″ Mill





28″ × 68″ Z-Type Calender

DAVID BRIDGE & CO., LTD.

Specialist Engineers to the Rubber and Plastics Industries

CASTLETON, ROCHDALE, ENGLAND. Phone: Castleton (Rochdale) 57216. Grams: Coupling, Phone, Castleton, Lancs
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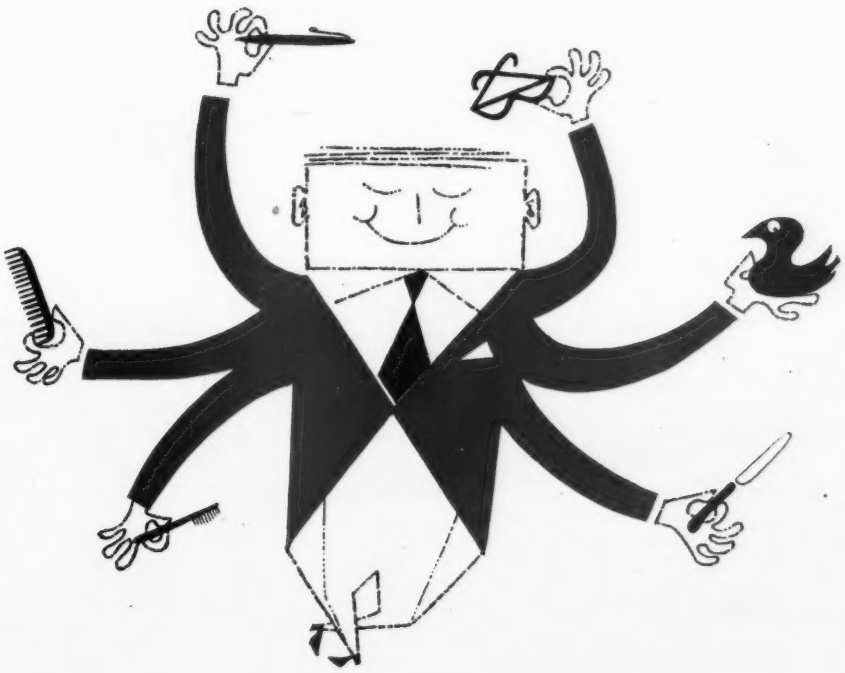
East Anglia's well known All-Rounder



'Standard' grade of East Anglia Plastics is a general purpose Cellulose Acetate moulding compound manufactured from medium Acetyl Flake. Toughness, light and heat stability plus ease of moulding are inherent in 'Standard' grade which is suitable for most applications not requiring the special properties of 'High Acetyl' grade.

'Standard' grade is generally supplied in a range of five flow grades: Hard, Medium Hard, Medium, Medium Soft and Soft Flow. Special flow formulations are also available to suit individual requirements. So varied is the range of colours in 'Eanplast' Cellulose Acetate Moulding Powders, that customers' needs can always be met by East Anglia Plastics Limited.

East Anglia Plastics Limited for Cellulose Acetate Moulding Powders

52 Brook Street, London, W.1. *Telephone: Mayfair* 4823 & 1973. *Telegrams: Eanplast, London.*
Factory at Temple Works, Strood, Rochester, Kent, England. *Telephone: Strood* 78441/2/3. *Telegrams: Eanplast, Strood, Rochester.*

EA P

GETTING WARM?

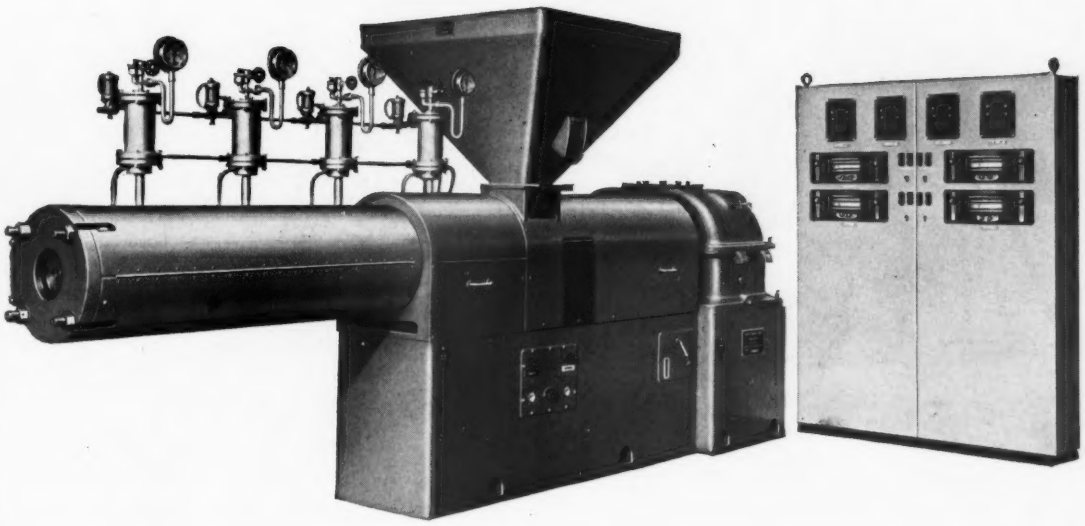
Fumbling around in the dark is no way to discover anything—especially the solution to a problem of major importance. Take the selection of the right polystyrene as an instance. You've got to have your eyes wide open there—to make sure of meeting the need precisely. That's how we go about anticipating and meeting the plastic industry's needs with an unsurpassed precision. Ask anyone who uses 'Kleestron' injection moulding or extrusion materials. Better still, ask us just how we can help you: Kleestron Limited, West Halkin House, West Halkin Street, London, S.W.1. Tel: SLOane 0866.

Kleestron

make a comprehensive range of general polystyrenes and impact materials—and will gladly supply technical details, prices, etc.

EXTRUDERS AND PLANT FOR THE PLASTICS INDUSTRY

descriptive folder sent upon request



This Extruder, built completely in our works has a 6″ diameter screw 16 diameters long and is fitted with the "Willert" Patent Vapour Cooling System and panel with electronic controllers. This system completely eliminates problems of overheating due to excessive frictional heat. It is entirely automatic and has no moving parts. There is no need for the operator to determine whether cooling should be "on" or "off". We build Extruders in all sizes from 1½″ to 8″ diameter with screws up to 24 diameters long.

Bone Brothers Ltd

Telephone—Perivale 9555/7

Telegrams & Cables
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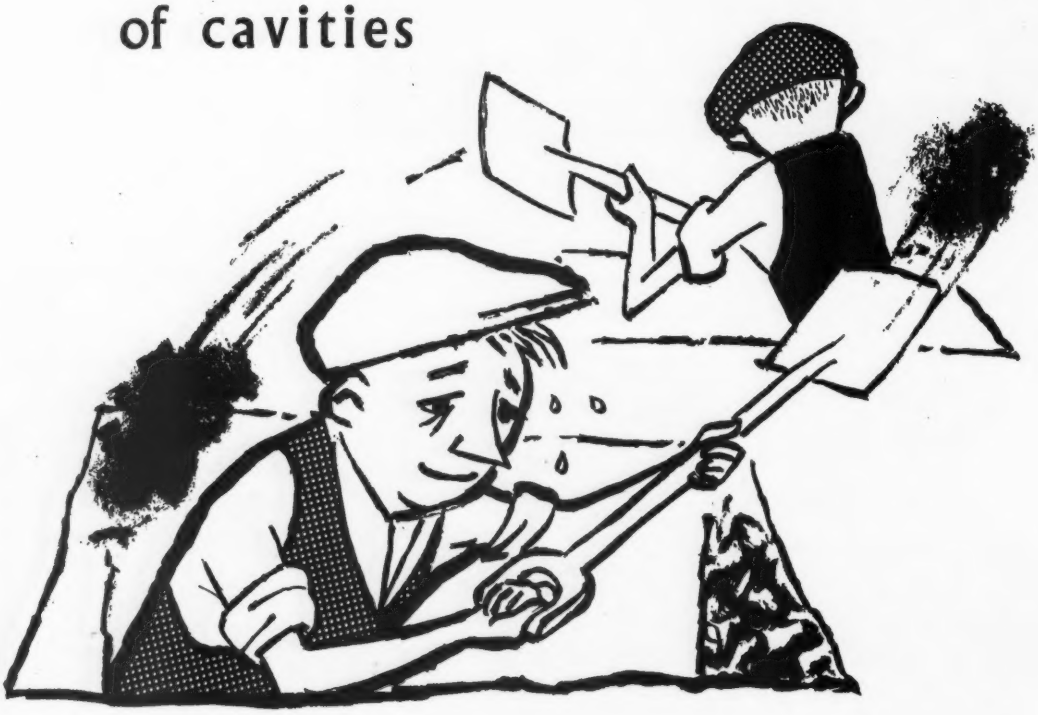
A question of cavities



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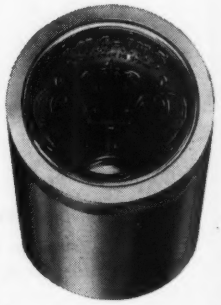

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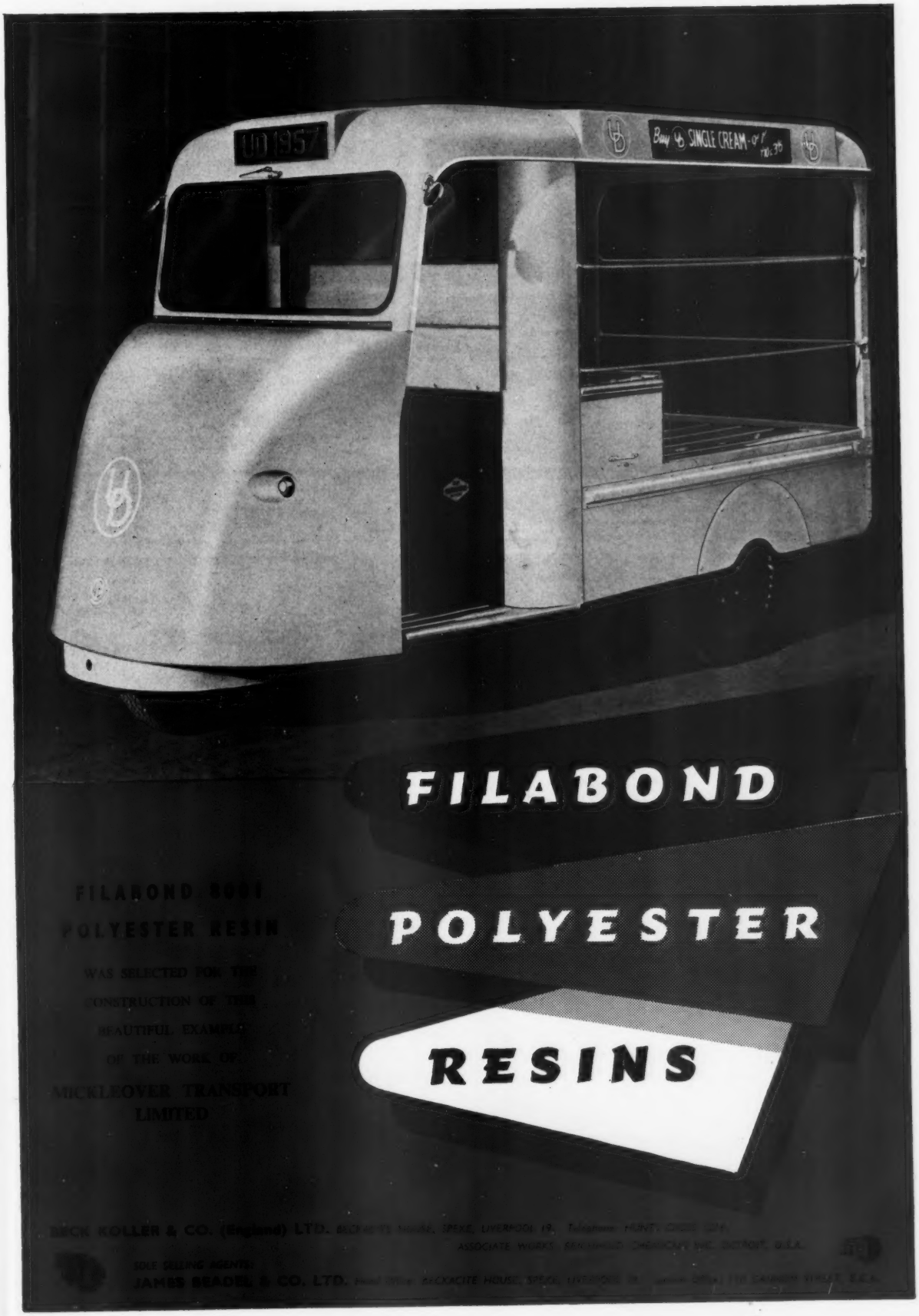
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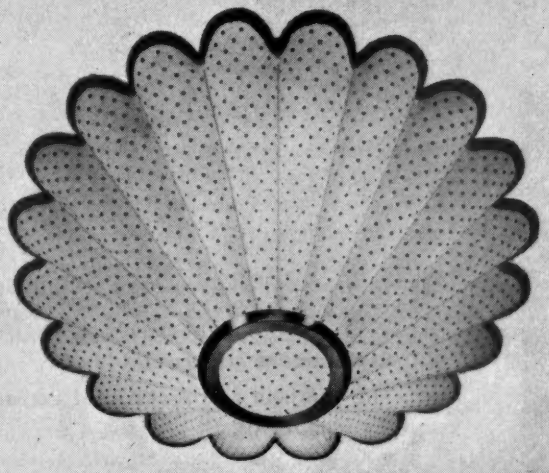

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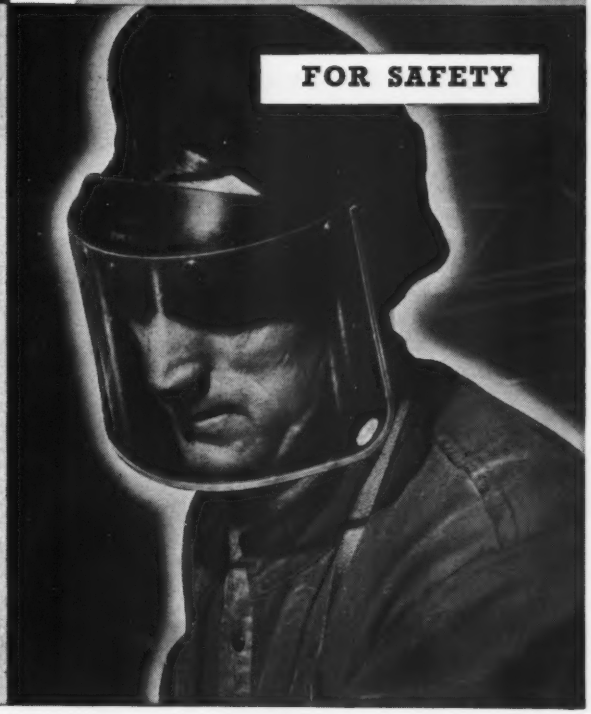

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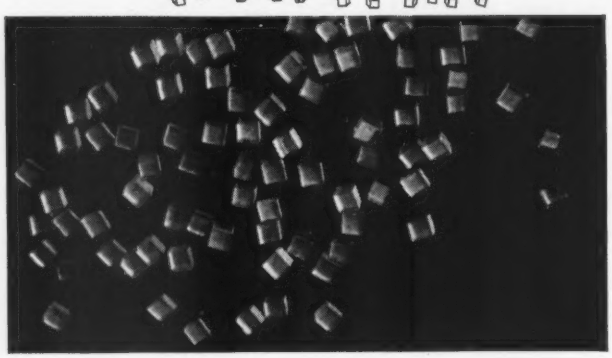

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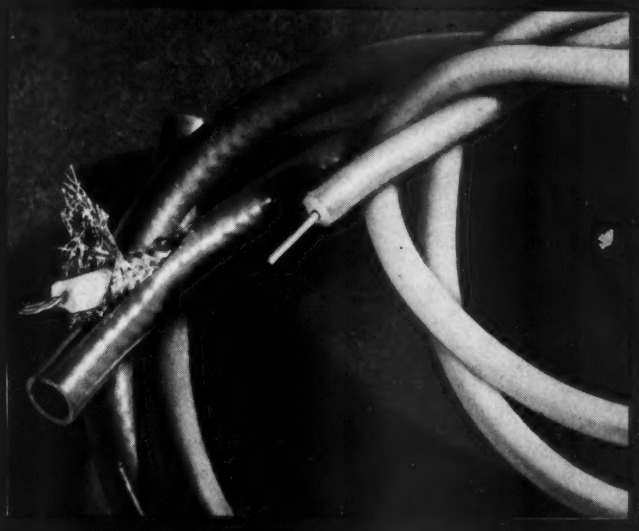

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TGA PP4

The wheels of a 3-ton truck have just passed over this junction box. It is still intact and working normally.

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A sapper removing a moulded protective cover to make connection to an 80-amp. socket.

Before acceptance by the Army this heavy-duty plastics junction box, moulded from BAKELITE material X199, underwent a really tough assault course. It was run over several times by a 3-ton army truck without damage, successfully withstood snow, ice, sleet and rain during field trials, and performed its duties in temperatures ranging from 125°F. down to –60°F.

Produced by the Witton Moulded Insulation Works of the G.E.C., the junction box will distribute 10 kW of lighting load — sufficient for an entire divisional headquarters in the field. BAKELITE Materials were used for all associated plugs and protective covers as well as for the box itself.

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Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

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Forming a welded joint in a section of p.v.c. belting at the laboratories of British Belting and Asbestos Ltd.

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NP49

where's the plastics?

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Plastics

VOL. XXII No. 234 MARCH, 1957

EDITORIALS

J. J. Berliner & Staff, Broadway, New York City, U.S.A.

WHAT! Not again surely?... It is with the greatest pleasure that we read in *Chemistry & Industry* of January 26, p. 110, of an apology offered to the Director of Research, The British Gelatine and Glue Research Association, by J. J. Berliner & Staff, 684 Broadway, New York, 12. The reason for the apology?... The American organization publishes and sells a large number of technical reports (I should imagine every chemist, chemical engineer, physicist and industrialist in Europe gets one of their frequent announcements) which one presumes are the work of the Berliner Staff. A recent one entitled "Gelatin" (Report No. 7306) was purchased by Mr. A. G. Ward, M.A., the aforesaid Director of Research, who found that J. J. Berliner & Staff had included in it his own paper "Recent Advances in Gelation Research" *without permission and without acknowledgement of his authorship.* Complaint by Mr. Ward brought along the apology.

We should like to relate to our readers our own experience with Messieurs J. J. Berliner & Staff, one time of Fifth Avenue, New York City. It is possible that the company is the same. The following is an editorial we wrote in our May, 1944, issue, that is nearly 13 years ago.

"One of the most important services that can be rendered to workers in scientific and technical fields is that of supplying abstracts of papers published throughout the world.

"Several institutions exist for this purpose, and for what is generally a modest annual sum the scientist can find on his table a useful list of short abstracts from journals relating to the subject in which he is interested.

"He can then, by buying the individual issue referred to, obtain all the fuller details he requires for the furtherance of his special duties.

"J. J. Berliner & Staff, of Fifth Avenue, New York, is one such institution which does this—and much more; perhaps we should say much more to the benefit of J. J. Berliner (possibly not Staff). Some months ago we received a postcard from this concern stating that it was issuing a special report on the subject of Metallizing Plastics. Our readers may well imagine how interested in this subject we are, since we had published, commencing in June, 1943, and have completed in this current issue, a very important and detailed analysis of the whole subject by Mr. E. E. Halls, an Englishman working on the problems here in London, Eng.

"We therefore ordered with considerable alacrity a copy of their report, and on its receipt were asked to pay the sum of £3 16s. 3d. in exchange. Now, this price is not too high for an important technical report. But we found it too high for our purpose and too tough for our gullets when we discovered that, with the exception of a small tailpiece, it was lifted, word for word and table for table, from Mr. E. E. Hall's first three articles in the June, July and August, 1943, issues of *Plastics*."

This may be very flattering to us, but on no page and in no hidden corner was any reference made of the source of this information. In fact, on the very expensive cover is a statement: "A Berliner Research Survey on New Development in Metallizing Plastics." Apparently Research Survey in Berlinese means the copying of other men's work, using the well-known apparatus made by the Roneo company.

"The irony of it all is that for this arduous task J. J. Berliner & Staff get £3 16s. 3d. for each copy, while all the proprietors of *Plastics* got for the three issues of *Plastics* was 4s. 6d. and had themselves to pay £3 16s. 3d. to see the same again in typescript."

The rest is silence. From that day to this we have received no expression of regret or hint of apology.

Research and Plastics

PLEASE read Dr. Melville's talk to students of the National College of Rubber Technology published on page 77 of this issue. We have said a lot like it before, but never so well and never so succinctly.

We are appalled at the lack of effort in carrying out pure basic research work here and we might well ask: how many British chemical, petroleum and rubber companies, in fact, do any such research on high polymers?

A couple of years ago, we gave a paper before the South Wales Section of the Plastics Institute under the Chairmanship of Mr. J. R. K. Russell, of Plastics Engineers Ltd., and we stated quite categorically that we believed that only one British company in the above fields had ever spent a lot of money and had carried out pure basic research. The overwhelming tendency is to purchase American or other licences and "know-how"—and to sit back with a strange glow of self-satisfaction. It was no bad thing to do in the immediate post-war years, but what of the future? We must wake up to the implications behind the situation.

P.T.F.E.

DURING the month of February we saw the first exhibition of p.t.f.e. held in this country, and although during the last few years we have handled this material in a mild fashion to examine some of its possibilities and have seen a few moulded and machined forms made by the few companies in this country and France that produce them, the above-mentioned exhibition was startlingly fascinating and covered a much wider field of moulding and fabrication than we had thought.

Polytetrafluoroethylene has been called by some who have used it, the King of Plastics and whilst it would be generally invidious to attempt to place other plastics in relation to it in a "plastic Burke's Peerage," there is no doubt that this rare and remarkable polymer stands head and shoulders above any other if we judge it by its unique combination of properties. Electrically, thermally and chemically, it is an outstanding material. It is not only the most valuable technical plastic we have—it is also one of the most difficult to produce and is still the costliest on the market, despite a recent reduction in price from £5 to £2 a lb. Without doubt too, it is one of the most difficult to mould, but it is also the most rewarding to use in technology for it has solved many problems that have irked workers in many fields; in cables, especially where high electrical values are required in conjunction with high temperatures, in high-pressure chemical systems, in bearings and working surfaces where friction is a problem.

One astonishing fact is that so few members of the plastics industry as such have concerned themselves with p.t.f.e. Nearly all the work (outside the laboratories of I.C.I. Ltd., who make the polymer) appears to have been done so far by the electrical and engineering industries.

It is, of course, a fact that new techniques have to be learned. The very nature of p.t.f.e. demands a radical re-appraisal of fabricating methods. For example, in order to make a tube, a pre-form is produced by means of a ram extrusion unit; the p.t.f.e. powder has incorporated with it a small quantity of a light petroleum fraction and the tube thus extruded has a smooth finish and provided that it is handled carefully can then be moved to an oven where sintering is carried out at about 360° C. To support the tube in its preformed state, a metal rod is delicately located through the bore. Scrupulous cleanliness is essential, to avoid the easily arising contamination of the material which would result in a reduction of its high dielectric properties.

Moulding p.t.f.e. also calls for the manufacture of a pre-form under pressure, followed by heat treatment, and here a further problem arises, the 25% volume increase of the material which occurs at 327° C. Since the sintering temperature is again about 360° C., it is sometimes necessary to sinter and cool the moulding in the mould.

It is all the more extraordinary therefore, the plastics industry as an entity, with all its experience in the handling of polymers, has largely ignored p.t.f.e., leaving it to electrical engineers, cable makers, instrument makers, chemical plant manufacturers, and general engineering concerns to evaluate the material and to put it to work. This King of Plastics is far too valuable an asset to our industry to be allowed to remain outside our technology. Perhaps the recent exhibition will stimulate interest anew, and bring home to our moulders and fabricators the importance of p.t.f.e. in the range of plastics we have to offer to our customers.

MOULDING POWDER AND SHOT

Abstract from recent paper on polyester/glass fibre mouldings for commercial vehicles: "The much maligned bucket and brush are used because they provide a readily available means of applying polyester resin to glass reinforcement. In effect, the operator is given a quantity of liquid and a piece of glass mat. First using the brush as a spoon, he ladles out the resin, wetting the glass as evenly as possible. Then, as the binder in the glass dissolves, the bristles of the brush are used to consolidate the moulding and to remove air bubbles. The armchair experts are at pains to point out the utter impossibility of producing satisfactory mouldings by this process, but the fact remains that satisfactory mouldings are produced and used in very much larger numbers than is generally realized." Who are these armchair experts and what do they look like ? By an extraordinarily lucky chance I managed to get

Armchair Critic

a photograph of one of them with my special camera (the one I have with the lens stuck in my tie and looks like a ¾-in. diamond pin. Here he is in the centre of the photograph, trying to look intelligent at an electronically controlled extrusion unit; all that one could hear from his lips was "What will they think of next !" and a disgruntled "Well, I don't suppose it really works, anyway." With his loud checked suit and shifty eyes he looked an escapee from the half-crown ring at Epsom racecourse.

* * *

Looking at my favourite strip cartoon in my favourite financial journal recently, I noted the Editor seemed worried over the fact that we have no indigenous supplies of the very important and costly metal vanadium we use for our jet engines. As a matter of fact there is quite a bit, but I'm the only one who knows where it is. I really ought to start making my first million by launching a new company, Vanadium Recovery and Industrial Chimney Sweeping Co. Inc. Let me tell you an exciting and almost true story. Many, many years ago, in the bloom of my youth and far from these shores, trying hard to raise an honest peso by raising steam in a petroleum refinery, I met a very lovely film-star named Del Rio up in Mexico City. You may well imagine what two young lonely souls talk about in Mexico, so, like O. Henry's heroine and hero, we spoke of this and that, of salt domes and synclines, of the then latest geochemical theories of the formation of petroleums from sea-bottom fatty acid decompositions under high temperatures and pressures—and then quite quietly and casually she mentioned that her uncle (or it may have been her grandpappy), another Del Rio, was the first to discover the presence of vanadium in petroleum. Well, to cut a tremendously long story short, I couldn't get away quickly enough (and how happy she too seemed to be) and beetled off down south to my refinery with its 50 boilers and more petroleum stills and started scrabbling and scraping away up the chimney walls—having carefully shut off the oil burners first, of course. We collected quite a tidy bit of vanadium pentoxide that way, and every six months or so, shipped it off to England. It's all quite true. Most petroleums contain vanadium (probably responsible for their catalytic formation from marine animal and vegetable sources, the ash containing sometimes as high as 10% to 40% of vanadium pentoxide). Since we are turning over more and more to fuel oil (with Comrade Nasser's permission, of course) as our national source of energy—what are we waiting for?

Strange Tale from the Hills

* * *

Nice de-icing job in Sweden ! Taking advantage of the difference in temperature between surface ice and underlying water at between 25–32 ft., the Harbour Board of Vasteras city have succeeded in making a 51 ft. wide ice-free fairway between Vasteras and adjacent harbours to the open water outside Sodertalje, a distance of 62 miles, by pumping air through a plastic tube with outlet holes drilled into it at predetermined points. The plastic tube, 960 ft. long, was laid on the bottom of the harbour bed and other points. When the plastic tube was installed the ice-cover was about 2 ft. thick. After 20 hours holes appeared and after a further fortnight the holes had a diameter of approximately 32 ft. forming an almost unbroken channel. After the installation had been working longer the channel was about 60 ft. wide although no normal melting of ice by increased air temperature had occurred.

No Ice in the Fairway!

DOGSBODDY.

Modern Bottle-Making Factory

IN our August, 1954, issue we published a review of the technology of plastic bottle manufacture by Mr. B. Strong, of E. Shipton & Co., Ltd., describing the various methods and machines employed. The review covered injection moulding and sealing (that is body to base), injection moulding and blowing, and extrusion followed by blowing, with special reference in the last named field to the semi-automatic and completely automatic machines invented by E. Shipton & Co., Ltd., and employed at their works at Northwood Hills, Middlesex.

Since that date advances have been more rapid than ever, perhaps the most important economically being the increasing acceptance of the polythene bottle by the vast cosmetic and pharmaceutical industries: both powders and liquids can thereby be attractively packed and dispensed by simple squeezing into a spray form from a bottle that is not only truly unbreakable but also is ultra-light and highly resistant to most chemicals. The more rigid and often larger type of bottle is finding increased use for the packaging of acidic or otherwise corrosive chemicals in powder and liquid forms, the all-round improved safety factor over glass introducing important savings in actual packaging costs.

Nylon Bottles

Within this period nylon bottles have made a welcome appearance, thus making possible the introduction of sterilizable baby feeding bottles and other obvious types for the medical profession. The former has already been widely accepted by the public and by hospitals. The nylon bottle for the carriage and dispatch of sensitive liquids such as blood plasma has obvious attractions again because of sterilizability and greater transparency than polythene in addition to lightness and strength, but acceptance appears to be in obeyance still—which may refer to the limited demands for such bottles and therefore higher cost.

Referring back to polythene bottles we may remark on the very important advance in the past year or so of improved printing. The difficulty of obtaining good adhesion of inks originally had clearly militated against expanding use, since not only is " art printing " for eye-appeal of outstanding importance, but " directions for use " in type printing is equally so. The more modern printing machine coupled with specialized inks produced by many makers and the introduction of certain surface-active agents appear to have solved this difficulty very satisfactorily as can be seen from the samples shown at the

Shipton's new factory at South Ruislip, Middlesex. A view down the main finishing line. To the right are some of the blow-moulding machines, the products of which are fed directly on to the continuous belt.

head of this article. Indeed the printing on all is exceptionally scratch resisting.

Perhaps the clearest indication of general progress in this field is the second factory erected by E. Shipton & Co., Ltd., on the new industrial estate at South Ruislip, Middlesex, which has been designed from the outset as a plant incorporating a wide adoption of mechanical, electronic and other automatic controls, so far as the bottle production machines themselves are concerned and an excellently designed flow of the moulded bottles from machines to preliminary inspection, finishing operations and final inspection. The machines are self-contained and only need plugging into the electricity supply and to a water connection for cooling, this providing for unit expansion.

There are nine extruder-blowing machines at present installed with a total capacity of 20,000 bottles per hour and provision has been made to increase the number of machines by 50%. The Shipton machine is exceptionally flexible and comprises an extrusion screw to which are fitted a number of nozzles feeding, as desired, from two to six moulds (during our visit the six-nozzle machines were producing " lemon " shaped bottles for holding lemon juice, in rapid sequence).

The action for double-feed may be roughly described as follows:—

1. Mould A is opened with the control valve left in the position which feeds polythene from the screw to the nozzle immediately above and between the two halves of the mould A. A controlled and sufficient length of polythene is extruded vertically downwards and the control valve is then operated so that the material is separated from its main mass by means of a cutting edge within the valve.

2. The valve is then in such a position that the flow of polythene is connected to the next nozzle for feeding to mould B.

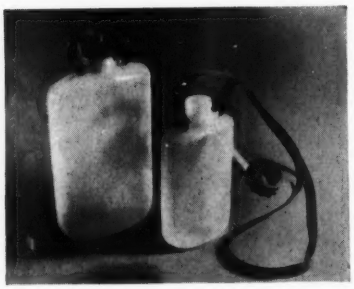
3. Mould A is then brought together and closed and air is applied through a core pin to expand the plastic within.

4. Similar action occurs with nozzle B and mould B and the control valve returns to the original position for feeding nozzle A.

5. Mould A is now opened and the completed bottle drops away so that the cycle can re-commence.

The flexibility of these machines, semi-automatic and automatic, is exceptional, since entirely different bottles having different weight per unit length ratios and if desired, different cross sections may be moulded on the same machine at the same time. Thus it is possible to mould for a multiplicity of customers on the machines.

The layout of the whole plant and the inspection and finishing bays can be seen from the accompanying photographs. As will be obvious, the output of the machines is fed to a conveyor system which directs it into different channels. Thus the bottles first move to the drilling station (six machines are available here), where the more or less closed neck is drilled to full diameter. Thence they may be moved to any subsequent operational points such as printing, etc., or if no such operation is required, to the counting and packing stations. There are six such stations on the belt each of which automatically receives the types of bottle which are directed to that station, and inspection packing and automatic batch counting by means of an " electronic eye " are carried out at high speed.



One of the more unusual products of the blow-moulding process; water bottles of half and one pint capacity, with p.v.c. sling. All Shipton's moulded bottles are sold under the trade name of " Polytainer."

Something of the running costs so far as labour is concerned may be gauged by the fact that a total of about 25 operatives are employed on this production side. Since the machines themselves need little and no continual supervision a " wandering " engineer is in charge of the total number on each shift and the remaining operatives, all women, are concerned with drilling, printing and packing.

There must be few branches of the plastics industry with a brighter future than this. Whether or not we believe that the glass container industry (nearly 4,000,000,000 are produced annually in this country alone) will ever have occasion to worry seriously about this comparatively new venture is anybody's guess, but between 18,000,000 to 20,000,000 polythene bottles were produced in 1956 (that is, only 0.5% of glass production), and their value has been clearly recognized. There is no doubt that with greater production of raw material (inferring a downward trend in costs and selling price) and perhaps improved qualities, we shall solve the economic and technical problems that at present hold up the coming of the plastic milk bottle, obviously one of the greatest possible outlets for the future. In addition there is also the closer promise of the " aerosol " bottle which itself shows no small market.

Finishing and inspecting bottles as they come down the continuous belt from the moulding machines.

Research and Plastics

By H. W. MELVILLE, D.Sc., F.R.S.*

Excerpts from an address given at the 3rd Convocation of the National College of Rubber Technology, London, on February 28th.

IN this address I should like to say something to you about the importance of non-metallic materials in our modern economy. As students you deal with an important part of this activity, namely rubber. But rubber is only one of a number of these materials, though naturally a very important member of the group. Of the substances used to make manufactured articles steel naturally heads the list, though of course, it must be protected normally by a film of a non-metallic material. It is cheap, versatile in its applications and is likely to predominate in the foreseeable future.

Non-ferrous metals come into quite a different category. Although their uses are extensive and extending in some cases such as aluminium their consumption totals only about 2 million tons per annum as compared with 20 million tons for steel. In tonnage, non-metallic materials such as plastics, rubbers, man-made fibres, amount to about ¾ million tons per annum and thus the total amount is of the same order as that for non-ferrous metals.

More specifically it is important to see where this country stands in relation to others and this is particularly vital to those of you who are shortly going into the industry to help maintain our position in this country as one of the leaders in this field. Maybe the younger among you are not very much concerned with such awkward things as the balance of payments, export quotas, high technical efficiency in industry and the like, but unfortunately these are some of the things that determine our standard of living. Nobody wants that standard to decrease—quite the contrary—but if it is to increase we in this country have got to make a really determined effort in the technological field even to maintain our present competitive position. It is often said that in this country we are good at making fundamental discoveries but we are not nearly so good at exploiting sufficiently rapidly to profit by these advances. The first part of the statement is a nice comforting thought that might easily lull us into a completely false sense of security and lead us to relax our efforts in this particular field. It is therefore worthwhile to look at this question particularly in relation to non-metallic materials. What have we got to our credit in this country. Consider first man-made fibres. Cross and Bevan were the originators of the process of converting cellulose into viscose fibres—a major advance that has given us a great lead in this country in the production of fairly cheap man-made fibres. Terylene was a British discovery but nylon was an American one. Apart from Terylene all the other synthetic man-made fibres of any importance such as Orlon and its variants have been discovered on the other side of the Atlantic—so we have no monopoly to boast about in this field. In the synthetic rubber field we have followed far behind in spite of the fact that over 60 years ago Tilden found how to make synthetic rubber. Germany and the United States have such a lead that we shall be hard put to it to catch up. Besides the United States have developed entirely new kinds of elastomers like chloroprene and butyl rubbers which, though not competing tonnage-wise with the standard G.R.S. type of rubber, have a vital part to play in the economy because of their specially developed and useful properties.

In the plastics field the situation is much more to our credit. The phenolic and urea plastics owe a lot to British development but nothing to British innovation. Germany may claim a major share in the development of the well-known polyvinyl chloride. Polythene is the British star. We were clearly first in discovery and development. Likewise Perspex owes its development to British enterprise, but in this acrylic field Germany had a great interest even before World War II. The story of polystyrene is one to be told in Germany and in the United States, but not in the United Kingdom, for it is only recently that extensive manufacture has even been started in this country. Polytetrafluoroethylene was wholly a U.S. discovery and its difficult development due entirely to U.S. enterprise. There has been another vital development which may well alter the picture in the non-metallic field to a very considerable extent. This is the discovery that unsaturated simple hydrocarbons can be polymerized at low temperatures and pressures, that is to say, under very mild conditions to give a variety of materials such as plastics, elastomers and even fibres. This is a development initially done in Germany and independently in the United States, and pursued with great vigour in Italy. The raw materials are exceptionally cheap since they are derived from petroleum. The processes are relatively simple and the possible future developments are enormous. Britain has had no share at all in these developments, and this has been much to our disadvantage.

Many of these advances in polymer chemistry have been accidental observations in a laboratory peopled with investigators of proved merit with acute minds and can lead to rapid and profitable development. On the other hand, sometimes they are the result of painstaking systematic investigations with other objectives in view such as happened with nylon. But these are just the conditions which obtain in the laboratories of this country, yet we have no more than a modest share in all these advances. Maybe this is to be expected on a statistical basis, but I feel we might have had a much larger share in the initial discoveries at any rate.

On the exploitation side we, in this country, have laboured under very considerable difficulties. These have been partly due to the aftermath of the war for, owing to the absence until recently of petroleum refineries of any magnitude, and therefore an associated petrochemical industry, the raw materials for the production of wholly synthetic polymers have been lacking. Fortunately for the synthesis of nylon and of Terylene the raw materials could largely be derived from coal but the total tonnage of these fibres produced is only about 25,000 and is therefore only a small proportion of the total weight of non-metallic materials produced in this country. Unfortunately it is not practicable to base such an economy on coal tar and therefore it is inevitable that the basis should be on petroleum as a starting material. The situation however is changing rapidly and though much of the materials depend on imported oil as a basis this is fortunately a fairly flexible system and there is now no excuse to synthesize the starting materials needed for all the different kinds of polymer currently known.

Therein lies a most important matter. This industry of non-metallic materials will expand enormously in the future. Into the products there has got to be incorporated an immense amount of know-how both purely scientific and technological. If one makes a pure chemical, even synthetically such as adipic acid, it is possible to specify the purity of the chemical, and if such a chemical is produced from two or more sources then there is a guarantee that it will be exactly the same from such sources. On the other hand, if we make nylon from that adipic acid and chemically we designate it as polyhexamethylene adipamide that's no guarantee it will ever make a good textile yarn. Much highly specialized knowledge has got to go into the preparation of the polymer and its subsequent spinning into a suitable fibre. Naturally, the incorporation of that knowledge is reflected in the value of the fibre. This is where British brains and ability can be utilized to the maximum extent. Unfortunately in this country we are not now well endowed with raw materials for this kind of chemical industry. We hope we are endowed with brains though we have to watch that too as I have indicated above. We hope we can develop a high degree of technical skill. If we are to survive we must utilize them to the greatest extent. Nowhere can this be done better than in the field of non-metallic materials where the best possible quality of such materials can only be obtained on the basis of extensive and accurate knowledge.

* Secretary, Department of Scientific and Industrial Research.

High Duty Nylon Piping

The use of plastics in the manufacture of piping is an important and growing field of application. This article describes the production of nylon pipe at the West Drayton factory of Richard E. DuPont Ltd.

THE physical characteristics of Nylon 6 are such as to make it a material of profound interest to engineers in terms of pipe systems. That greater progress has not been made so far in exploiting this obvious and highly important field is probably due to the extrusion problems associated with nylon, principally the degradation factor and excessive fluidity over the melting range. The surmounting of these purely practical problems has involved considerable research, by the material manufacturers and the designers of extrusion equipment.

As an example the type of application open to nylon pipe, given suitable material and satisfactory processing conditions, the employment of it for marine use may be cited. Here, the requirement is stringent in that many thousands of feet are required for each vessel for the pumping of sea water, the pipe to be open to all weather exposure in conditions ranging from tropical to arctic. Associated with the requirement is the provision of nylon couplings, and a considerable quantity of fabricated bends. Work on this project is at present in hand at the West Drayton factory of Richard E. DuPont Ltd., where the photographs on these pages were taken.

This company is part of the well-known group in the metal tubing industry, and some considerable time ago commenced an investigation programme on plastics with the object of selecting the most suitable materials for piping and suitable equipment for fabricating it. The West Drayton Plant represents the culmination of this investigation and although not yet fully equipped already constitutes a powerful production unit.

One of the materials employed is Nylon 6, manufactured by Holzverzuckerungs A.G., of Switzerland, the subject of a series of articles in *Plastics* recently (June, July and August, 1956). It is marketed under the trade name " Grilon " and the grade used is of the high molecular weight type based on caprolactam. Having a broader melting range than many polyamides, ±5° C. of the true melting point of 215° C., the material is characterized by a shallow viscosity curve between the melting and decomposition temperatures, coupled with a high viscosity at melt. It is therefore particularly suitable for the extrusion process. Apart from the practical extrusion advantages of this special high molecular weight material another important factor is that it imparts a high impact and reversed bend strength to the finished pipe, and furthermore the pipe is resistant to hot water and the subsequent so-called water fractures.

The extruder selected by Richard E. DuPont Ltd. is the S.90 R.G.V. machine manufactured by A. Reifenhauser, of Troisdorf, West Germany. Having a screw diameter of 90 mm. and a screw length/diameter ratio of 15 : 1, it has been designed to handle polyamide materials to be linked also with Reifenhauser vacuum calibrating head and take-off equipment. With an output of 150 lb. of material per hour the plant represents a high level of technical development, and the company have found it to be very satisfactory in service.

The successful extrusion of nylon pipe of large diameter (in this case 5 in.) is dependent on a number of factors, namely: (*a*) the properties of the nylon; (*b*) the design of the extruder; (*c*) control of temperature; (*d*) dimensional control both at the head and in the cooling zone; (*e*) cooling and take-off. These factors will be discussed in relation with the illustrations.

Nylon Properties

In addition to the points made above the material must be completely dry as moisture contamination will greatly affect the extrusion conditions and quality of the finished pipe. For this reason it is supplied in air-tight vacuum sealed containers. Furthermore, the molecular weight and other properties must be absolutely standard from batch to batch as any variation may completely modify temperatures and pressures employed.

Extruder Design

The screw design called for here is one that will yield a compression ratio of 1 : 4, made possible either by a suitable gradual increase in the pitch of the screw, or a decrease in the depth of the thread. The base and wall of the thread should be at right angles to facilitate the feed of the material.

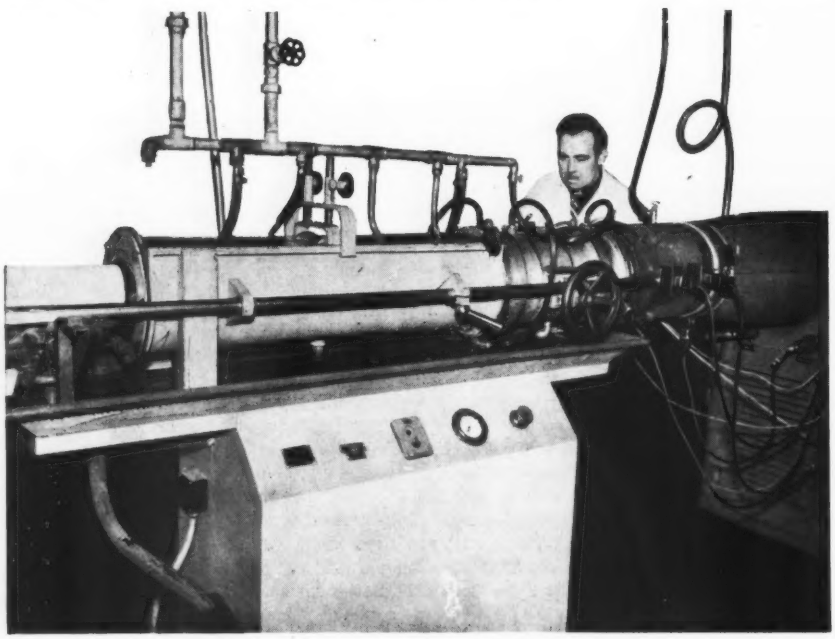


Fig. 1. Vacuum calibrating die for large diameter pipe.

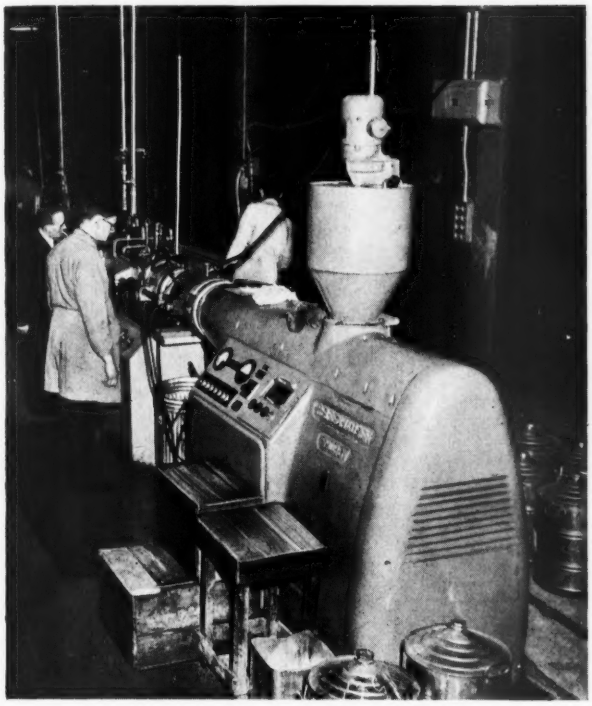


Fig. 2. General view of Extruder.

Temperature

Important in all extrusion processes temperature control is vital with nylon despite the increased tolerance conferred by "Grilon." Thermocouples, located as near the barrel lining as possible, as well as thermocouples in the die-head, must be regarded as standard equipment and temperature control on the West Drayton Plant is $\pm\frac{1}{2}^{\circ}$ C.

Dimensional Control

The development by Reifenhauser of a vacuum calibrating former die has marked a significant step forward in the production of high quality nylon pipe. The calibrating die is in two parts, the first comprising the vacuum chamber and the second a sizing zone 2% greater in diameter than the external diameter of the pipe itself. The attachment is fitted to the die-head and is seen clearly in Fig. 1. Although by no means solving all the problems involved in manufacturing large diameter nylon pipe, DuPont have found this equipment of Reifenhauser a valuable adjunct. A general view of the extruder is seen in Fig. 2. The vacuum calibrating head is seen in the background of the photograph.

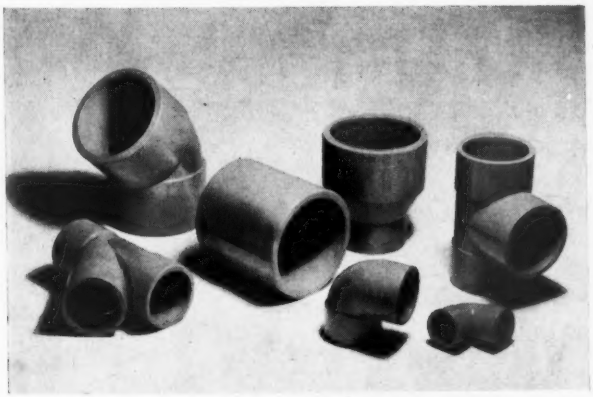


Fig. 4. Typical injection-moulded fittings.

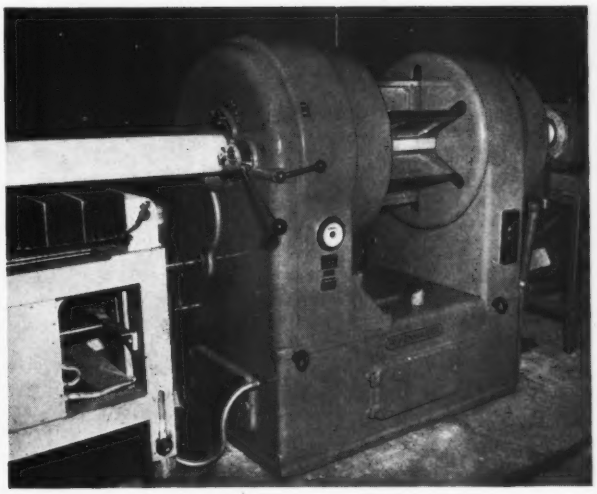


Fig. 3. Haul-off equipment in operation.

Cooling and Take-off

On emergence from the vacuum calibrating head the extrusion is passed through a water bath 30 ft. long and then enters the haul-off equipment also supplied by Reifenhauser. Comprising a series of pressurized and shaped belts (see Fig. 3), the unit is operated by a $1\frac{1}{2}$ h.p. electric motor with accurate speed control. Synchronized with the unit is a reciprocating circular saw automatically cutting the pipe into predetermined lengths. The pipe is then ready for despatch.

From extruded lengths are also cut the sections from which special bends and unions are fabricated, examples of which are shown in Figs. 4 and 5. Elsewhere in the West Drayton factory are injection machines for the moulding of pipe couplings in nylon, for which a suitable grade of "Grilon" has also been evolved, and also couplings in polythene and Kralastic. Still a comparatively young member of the Plastics Industry, DuPont have demonstrated by the scale of development indicated here that plastic pipes are now an important part in the group's overall production programme.

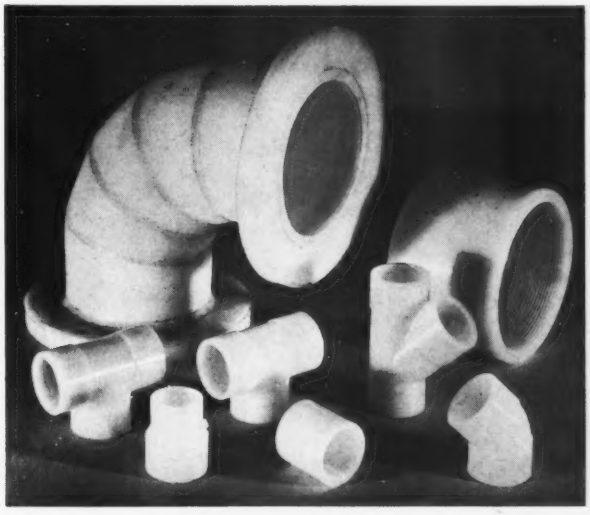


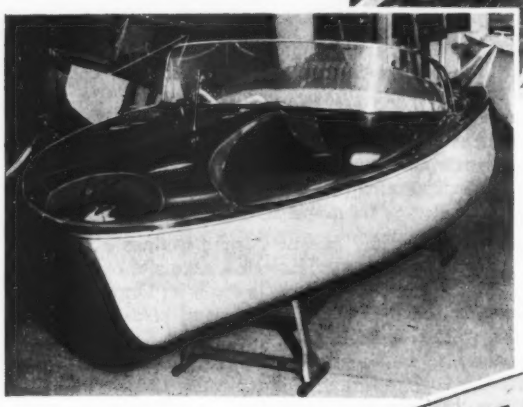
Fig. 5. Small and large coupling units.

The National Boat Show

A pictorial record of the contribution of plastics materials to boat construction and fitting. A technical report appeared in the February issue of "Plastics," page 40

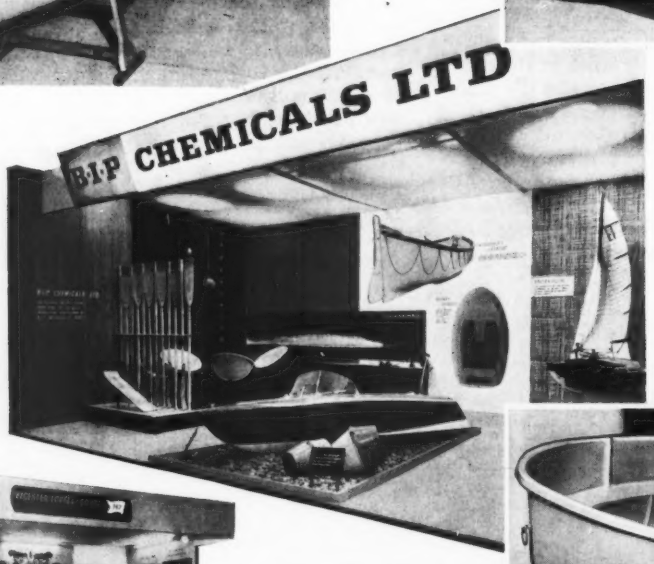
(Above) Resin bonded laminated wood hulls, shown on its stand at Fairey Marine Ltd.

(Left) Shown by B.I.P. Chemicals Ltd., Miss Windermere III, manufactured with the aid of Beetle adhesives.



(Above) An exhibit of Willerby Plastics, of resin-glass construction, employing Bakelite polyester resins.

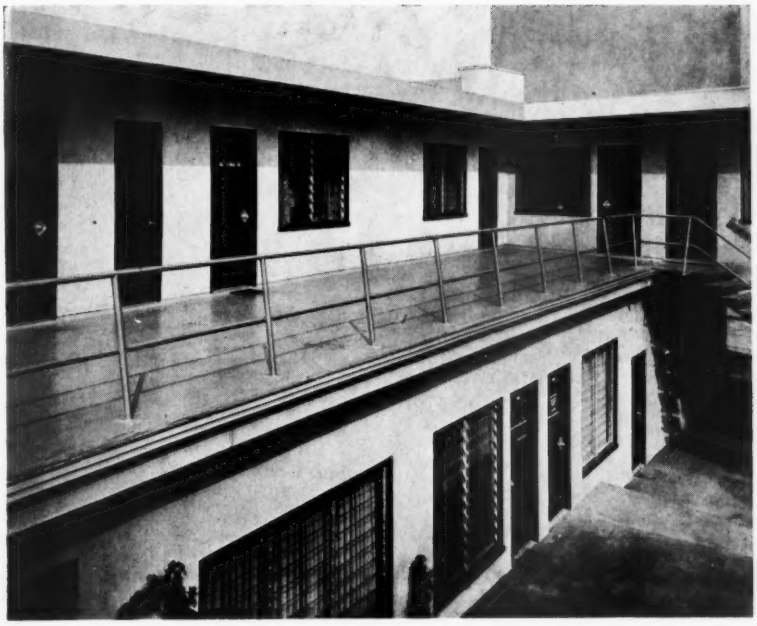
(Above) Exhibit of Ceacraft of Solihull; glass fibre hulls are bonded with Bakelite polyester resins.



(Left) The stand of B.I.P. Chemicals Ltd.; in the foreground is a boat bonded with B.I.P. polyester resins.

(Left) The stand of Leicester Lovell & Co. Ltd., showing synthetic glues for boats.

(Right) 8-ft. dinghy of Maximar Mouldings Ltd., in resin-glass.



New Uses for Cellulose Coatings in U.S.A.

By T. A. DICKINSON

A material long used by shoe manufacturers is now finding opplication in the protection of wood and metal surfaces. Some of the interesting American uses are described.

Impregnated cotton coating applied to the sun-deck of a Californian building, cutting renovating costs, and preventing water entering ground floor rooms through plywood seams.

A MATERIAL long used by American shoe manufacturers to reinforce leather heels and toes has recently been found capable of providing unusually durable coatings for wood and metal surfaces, according to officials of Cal Distributing Co., Los Angeles.

Known as Celastic, it comprises cotton fabric impregnated with a non-inflammable cellulose nitrate resin. It is made ready for use simply by dipping it in an activator solution for a few seconds, after which it can be applied by manually bringing it in contact with a deposition surface.

The purpose of the solvent-type activator is to soften the fabric's cellulose impregnant, so that the latter will have the tack required to serve as an adhesive. Following an application, the coating will lose its surface tack in about an hour at room temperature. However, 24 to 48 hours of drying time must be allowed before the finish will withstand severe operating conditions.

In general, the impregnated fabric coatings are used where conventional organic finishes are either wholly or partly unsatisfactory—for example, on floor and deck surfaces that must withstand considerable abrasion and in the repair of broken wood tool handles. Virtually all of these applications, it should be noted, are of a functional nature. Where decorative colour effects are also required, it is usually necessary to cover the impregnated fabric coatings with organic finishing materials of the types commonly applied to pine.

Specific properties that indicate the use of impregnated fabric coatings include excellent adhesive qualities, high resistance to vibration and thermal expansion or contraction, waterproofness, non-inflammability, better abrasion resistance than asphalt tile, light weight, chemical inertness, and resistance to rot.

In addition, the coatings have the advantage of being extremely easy to apply. No preliminary priming of deposition surfaces is necessary; no special precautions are required to prevent such defects as sags and blisters; and no skill is needed to avoid undesirable variations in coating thickness. Even where edges must overlap and contoured or irregular surfaces must be covered, the softened resin-fabric material has enough mouldability to be uniformly bonded and faired—with the fingers alone—for optimum durability and good appearance.

Once it is adequately bonded to a given surface, the coating material can be sanded and machined with conventional wood-working tools, as if it were an integral part of the base material. Moreover, it can be buffed or polished until it has the lustre of metal.

Because the material is obtainable as sheets with varied thicknesses, the thinnest of which is thicker than a half-dozen layers of conventional lacquer, a specified functional finish can usually be obtained in one coating operation; however, several layers of the impregnated fabric can be applied, one over the other, if necessary.

In the construction of wooden boats, the material has recently been used as a substitute for glass fibre coverings, primarily

Fabric-impregnated coating on boat hull, providing abrasion resistance and weather proofing.

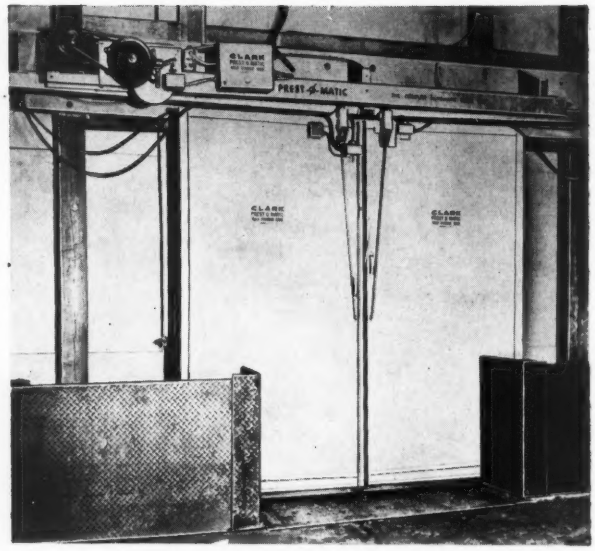
because it is relatively easy to apply and, consequently, most economical. Tests to date have shown that the impregnated cotton coatings are not only as waterproof as comparable glass fibre finishes, but more durable, thanks to superior abrasion resistance.

On such things as floors and stairs, the new coatings have proved themselves to be "skidproof" as well as unusually abrasion-resistant and durable, since they have a fabric-like texture in the unpolished condition.

Modernistic buildings with relatively flat roofs have defied most efforts to make them leakproof for many years. But some that have been covered with Celastic are now shedding water as effectively as the steepest of old-fashioned roofs. New tool handles, finished with the same material, not only have superior resistance to cracking due to weathering and rough usage; they have a more pleasant "feel," and are less likely to slip from a workman's hand.

Leaky metal containers or tanks of the types used in storing fluids have been reclaimed for years of additional usage by lining them with Celastic.

Other finishing applications that will be found for the old shoemaker's material should be numerous, if not unlimited. However, uses heretofore indicated seem to prove one point rather conclusively: it often pays to take a fresh look at things which are already common-place!

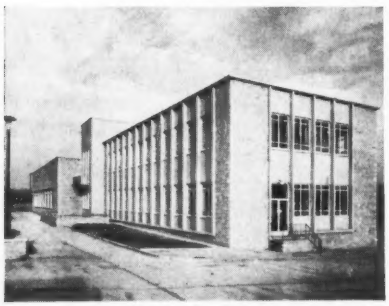


Refrigerator doors coated with impregnated fabric.

Research at British Belting and Asbestos Ltd.

INVESTIGATION into various aspects of the performance of plastic materials forms a large part of the work of the laboratory recently inaugurated by British Belting and Asbestos Ltd., of Cleckheaton, Yorkshire. A considerable percentage of the company's production is concerned with brake lining and other friction materials and, with the exception of sintered metal forms, such products are bonded with some type of plastic. As a result the laboratory is actively occupied with research into every form of plastic with heat resistant and mechanical properties. The particular function of the B.B.A. Laboratory is, of course, applied research and something like half of the work arising takes the shape of engineering tests.

The main plastics employed in the friction lining field are of the phenol-formaldehyde and allied classes. These are used by themselves, also in conjunction with natural synthetic rubbers and especially with cashew nutshell resins.



The new laboratories.

Actually nearly every resin or rubber that has any pretentions to heat resistance has at some time been adopted for brake lining manufacture and very many are still in use in successful compositions.

In the belting field the Cleckheaton company has been interested in the application of plastics for a period of something like a quarter-of-a-century.

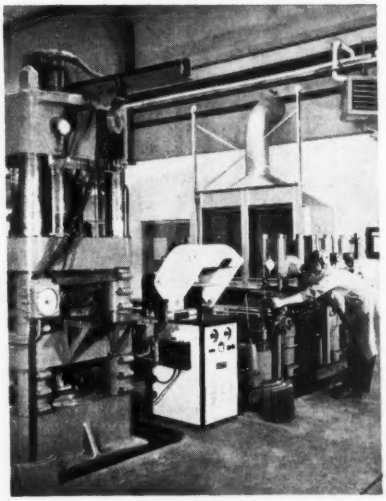
Experiments with p.v.c.-treated webbing were restarted after the end of the 1939–45 war, the product being applied as a hygenic, washable and oil-resistant food conveyor in 1946. Excellent anti-abrasion qualities were revealed and similar materials were tested in 1948 with a view of their employment for coal conveyor belting. Thus, B.B.A. claim to have been the first manufacturers of p.v.c.-coated coal conveyor belting.

Very soon the Creswell Colliery disaster focused attention on the importance of non-inflammable conveyor materials, and in the Scandura a belt with such qualities was readily available. Since that time millions of feet have been supplied to the National Coal Board. This material was originally made with just a p.v.c. coating but impregnation was later applied so that heavy wear should not affect the basic property of the belting. Scandura non-inflammable conveyor belting is part of the range manufactured by the B.B.A. associated company in the United States.

An important task for the research laboratory is the evaluation of synthetic fibres for various purposes. Among the developments that have been exploited is the use of non-inflammable p.v.c. in conjunction with asbestos textiles, an important use for such material being the manufacture of inter-coach railway corridor linkages. Investigations are being pursued into other uses for asbestos and plastic materials.

The company's original research laboratory was established in 1924 and, in the course of time, was divided up into sections for chemical work, for different types of pilot production, for production control and testing. A special sub-section was devoted to research into the combination of natural and synthetic rubber with asbestos.

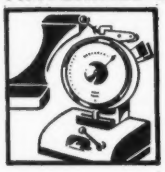
The new laboratory has been designed to bring most of the company's research and test work into one building. Routine textile testing, however, is housed in the textile production department. With a floor area of 23,600 sq. ft. the new laboratory premises provide more than twice the space previously available.



Hydraulic and electronic equipment.

World's Industry Employs Plastics

MATERIALS and TESTING



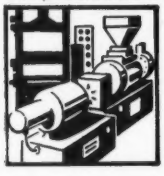
Plasticizers for wires and cables.—The ideal would be no plasticizer or at least a single plasticizer that would satisfy all demands of efficiency, low temperature flex, heat stability, permanence, etc., at low cost. At present the picture is very confused about desirable properties. In wire and cable at present the following breakdown of plasticizers can be given: phthalates 62%, phosphates 15%, polymerics 9%, low temperature types 8%, miscellaneous 6%.
(*Wire and Wire Products*, 1956/Oct./1215.)

Testing of soft-flexible foam materials.—German draft standards have been published for; tensile test, determining the remainder of pressure-deformation; determination of shock elasticity-endurance swinging test; and, tear test. Added are explanations.
(*Kunststoffe*, 1957/Feb./78.)

Volatility and migration of high molecular weight plasticizers.—A. Merz discusses the method of determining plasticizer volatility by the "active charcoal" method (ASTMD-120–52T) and the proposal of the ISO. These methods are compared with the "oven method" airstream.
(*Kunststoffe*, 1957/Feb./69.)

Nylon powder.—Finely divided nylon powders have been combined and provide exceptionally strong parts in cold pressed and sintered form. Inert fillers such as molybdenum disulphide, graphite etc. give specific properties.
(*Tool Engineer*, 1956/Dec./193.)

PROCESSES : MACHINERY



Injection moulding tools with cast-on ejector fittings.—The author, Heinrich Spies, gives practical details of die design for the embodiment of those features in the initial casting which facilitate the fitting of ejector pins and the like. The discussion is based on practical die designs which are included in the paper.
(*Der Plastverarbeiter*, 1957/Jan./13.)

Automation in injection moulding.—The possibilities of automation in injection moulding are examined in a short article by Rudolf Rhoen in the light of the method of operation of an electro-mechanically propelled automatic injection moulding machine, together with its essential ancillary equipment.
(*Der Plastverarbeiter*, 1957/Jan./16.)

New mixing and compounding process.—In the "vertical mixing" process the powder-like or granular material is made free flowing, by aeration, and can therefore be stirred like a liquid. The method provides for great simplification of the mixing apparatus.
(*Kunststoffe*, 1957/Feb./64.)

Cutting and turning of plastics.—Eighteen different American firms contributed to a survey on plastics machining compiled by R. A. Wason, in which in particular the newer plastics were considered.
(*Tool Engineer*, 1957/Jan./109.)

Multipurpose coating machine.—A universal capstan-type coating machine combines four different systems of applications. The coating apparatus revolves about a vertical axis; pressure is applied by levers rotating about a horizontal axis. German Patent applied for.
(*Kunststoffe*, 1957/Feb./74.)

Safety regulations for injection moulding machines have been issued in Germany, dated October 1, 1956. The regulations have been reprinted in full.
(*Kunststoffe*, 1957/Feb./75.)

Surface hardening of dies for plastic moulding and injection moulding.—W. Haufe notes that three types of steel are used for dies for moulding and injection moulding. Namely, intrinsically hard steels used in the as delivered state; oil or air hardening steels and finally steels for surface hardening. In the case of the last group surface defects can occur during case hardening or nitriding which result in the rejection of the dies. Thus in making the die it is essential that the greatest care be paid to those areas where such failures have by experience been shown most likely to occur. Properties required are good workability, good die sinking qualities, fullproof hardening, ability to take a good polish, ability to maintain polish, toughness, corrosion resistance and impact strength. The author illustrates his discussion with numerous tables, graphs and illustrations.
(*Der Plastverarbeiter*, 1957/Jan./2.)

INDUSTRIAL APPLICATIONS

Formvar and alkylphenolic coated magnet wire.—When polyvinyl formal (Formvar) is combined with an alkylphenolic resin generally a condensation product of formaldehyde with meta- and para-cresol) and suitably coated on wire, the resulting film has flexibility, abrasion resistance, solvent resistance, adherence and other desirable properties. R. E. Kass and G. Lavin have investigated the influence of salts on wet and dry dielectric strength.
(*Wire and Wire Products*, 1956/Oct./1207.)

A hook-up wire insulated by 0.010 to 0.015 in. Teflon in gauge sizes 16 to 28 has been produced. Teflon of controlled thickness is applied by extrusion to silverplated copper wire. It is supplied to National Aircraft Standards and Government specifications in 16 specified colours.
(*Wire and Wire Products*, 1957/Jan./81.)

Plastic impregnated sleevebearings.—W. Weber gives a survey on bearing materials with good running properties when dry which can be usefully employed in machines for the food, textile and paper industry, where usual oily lubricates are excluded. Recently, in particular sintered bearings impregnated with polytetrafluoroethylene showed extremely low friction and wear.
(*Konstruktion*, 1956/Dec./507.)

Sheet for plating tanks.—Calendered polyvinylchloride sheets are being used to construct self-supporting electroplatings. The large sheets 10 feet long were cut with an electrically operated hand saw to form the sides and the bottom of the tank. Spacer rods to hold the tank sides equidistant were made of lathe cut rods with plug shaped ends.
(*Products Finishing*, 1957/Jan./82.)

Plastics for gears.—H. Zickel gives a general survey of the development of plastics for gears by providing in particular the necessary calculatory data for the designer.
(*Industrieblatt*, 1956/Dec./501.)

Silicone insulated conductors, "Daglas".—A new type of fibrous insulated wire is a combination of glass and polyethyleneterephthalate fibres bonded with a modified silicone resin. Such a wire can withstand severe mechanical abuse. Other new developments are: enamelled magnet wire, aircraft wire, shipboard wire and cable, appliance and fixture wire, electronic hoop-up wire and a defroster wire.
(*Wire and Wire Products*, 1956/Oct./1217.)

MISCELLANEOUS USES

Packaging of foodstuffs in plastics.—The German Federal Government has proposed a law concerning the handling of foodstuffs and other essential goods as an amendment and completion of existing laws. They contain also the extent to which plastics can be used for this purpose, a problem of growing importance. L. Robinson-Goernhardt presents an up-to-date literary survey dealing with toxic and non-toxic plastics, compounding ingredients and other additives.
(*Kunststoffe*, 1957/Feb./54.)

Cast resins in motorcar-body construction.—A general survey of the development of this technique has been given by O. Gengenbach and R. Breitling. The technical advantages and disadvantages are pointed out. Some examples show possibilities and economies.
(*Werkstatt & Betrieb*, 1957/Jan./50.)

Plastic pipes and their use.—General survey of plastic pipes for installation purposes with additional notes on optimum methods of constructing household pipelines.
(*Industrie-Kurier* (*Technik & Forschung*) 1957/Feb./6/50.)

Plastics industry in Latin-America.—G. B. von Hartmann gives a survey of the development of this progressing industry. A Spanish edition of *Kunststoffe* is published every quarter year, owing to the strong support and interest in Spanish speaking countries. Personal impressions are given from a study trip in order to encourage mutual understanding.
(*Kunststoffe*, 1957/Feb./59.)

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Transparent Plastic Containers

SIR,—I wish to express my appreciation of the interest you have shown, and the efficient manner used, in dealing with my recent enquiry regarding transparent plastic containers.

Mr. Moncrieff, British Celanese Ltd., has now written us on this matter and has very kindly extended an invitation to visit that firm where a practical demonstration can be arranged and the subject thoroughly discussed. I will be pleased to accept this generous offer and propose visiting London for this purpose as soon as possible.

In these days, when one has grown accustomed to the most offhand methods, it is refreshing to have a query dealt with so competently. Thank you very, very much indeed.

FRANK D. PHELAN.

Clutch Service Ltd.,
Lincoln Place,
Dublin.

Swedish Ashtrays

SIR,—I would greatly appreciate it if you would be so kind as to advise me the name and address of the manufacturer of the ash trays illustrated on page 330, of the December, 1956, issue of *Plastics*. The article is on Swedish Plastics and is signed Dogsboddy.

E. HENRICKSON-LORENZI.

Consolidated Molded Products
Corporation,
Cannaregio, 358–A,
Venice,
Italy.

SIR,—We are very interested in the ash trays pictured on page 330 of the December, 1956, issue of your magazine *Plastics*. Will you please send us the name of the producer of these and if possible would you have them send us a sample and also a quotation on lots of 10,000 each.

HALSEY J. SORRELL.

Halsey, Inc.,
40 Poplar Street,
Scranton,
Penna.,
U.S.A.

Fibreglass Products in Australia

SIR,—We wish to contact manufacturers of glass-fibre products, who may be interested in having their goods produced and marketed in Australia.

Our company is one of the largest engaged in general fibreglass work in this country, using hand lay up methods, and quality and workmanship is guaranteed. We would be prepared to purchase samples from which to make our moulds, and pay a reasonable royalty on each article produced.

Owing to strict currency and import restrictions, it is extremely difficult to import finished products at the present time, and such an arrangement cannot fail to be to the advantage of all concerned.

T. J. HOLLINRAKE.

The Merlin Fibreglass Company,
Little Glover Street,
South Melbourne, S.C.5,
Australia.

Plastic Teats for Piglets

SIR,—For an entirely new appliance for the artificial rearing of piglets I wish to use teats far more tender, yet hard-wearing, than can be produced from rubber.

Can you supply me with the names of any manufacturers who might be making such teats from the very thin, yet hard-wearing materials used, for instance, for wrapping foodstuffs ? If so, I would be most grateful.

A. ERNST.

16 Robert Adam Street,
Portman Square,
London, W.1.

Plastics Machinery for Indonesia

SIR,—Our principals in Indonesia have requested us to quote on plastics machines as follows:—

1. Plastic extruding machines.
2. Plastic injection moulding machines.
3. Plastic granulating machines and/or machines which are required for the manufacture of plastic articles such as buttons, etc.

We shall be pleased if you will put us in touch with manufacturers of suitable machines.

N. SAXTON.

Startrite Sales Ltd.,
Waterside Works,
Gad's Hill,
Gillingham,
Kent.

Resin-Glass Caravans

SIR,—I have read with interest Mr. H. V. Blake's article on Glass Fibre Reinforced Plastics in Road Transport, which includes some comment on caravans moulded of this material. His summary of how far its use has been taken in the caravan industry is accurate, as one would expect, since his firm supplies some of the caravan manufacturers, but his reference to " the lighter weight " is perhaps misleading.

The fact is that our expectations of important savings in weight have not been realized. Comparing the all-moulded caravans with comparable models of aluminium on wood framing, the lightest one weighs about the same and the other plastics vans are heavier. I understand that this is also American and French experience —that the plastics van tends to come out heavier than with conventional materials.

It may be that further developments in design will make it possible to use thinner mouldings without loss of strength, or to reduce the weight of the chassis, but for the time being the sales appeal of plastics vans must rely mainly on good lines and the absence of body joints through which in time rain might enter.

W. M. WHITEMAN.

The Editor,
" The Caravan,"
Link House,
Store Street,
London, W.C.1.

Plastics Washers

SIR,—We require small washers to fit approximately $\frac{1}{8}$ in. bolts made from either polythene or some suitable plastics material from which washers can be made. At present we use cork washers on brass fittings used in conjunction with pottery cake plates, etc., and these are not very satisfactory as they break easily, and there is not enough " squeeze " to give a tight fitting without them splitting.

We are certain these polythene washers are made because the writer has come across various types of plastic washers used in valves and similar apparatus associated with diving gear. Could you therefore put us in touch with the most likely manufacturers?

W. R. MIDWINTER LTD.

Burslem,
Stoke-on-Trent.

RECENT DEVELOPMENTS IN CONTINENTAL PLASTICS MATERIALS

A symposium under the above heading, organized by the London Section of the Plastics Institute in association with the Borough Polytechnic, will be held at the Polytechnic on March 27, 9.30 a.m.–5 p.m. The following papers will be presented:—

" High-Density Polythene," by Dr. J. Von Klenck, Farbwerke Hoechst A.G.

" Polyurethanes," by Dr. P. Schneider, Farbenfabriken Bayer, A.G.

"Nylons," by Dr. Kessler, Algemene Kunstzijde Unie, N.V.

" Epoxides," by Dr. K. Meyerhans, Ciba A.G.

The registration fee for the symposium is 10s., and applications should be sent as soon as possible to the Department of Chemistry, Borough Polytechnic, Borough Road, London, S.E.1. Telephone Waterloo 7654.

THERMOPLASTICS IN THE SUBMARINE-CABLE INDUSTRY

A lecture under the above title will be held by the Plastics Institute on April 30. Constituting the 8th Annual Lecture, it will be given by Sir John Dean, chairman and chief executive of the Telegraph Construction and Maintenance Co., Ltd., in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Developments in the Casting of Steel Tools for Plastic Moulding

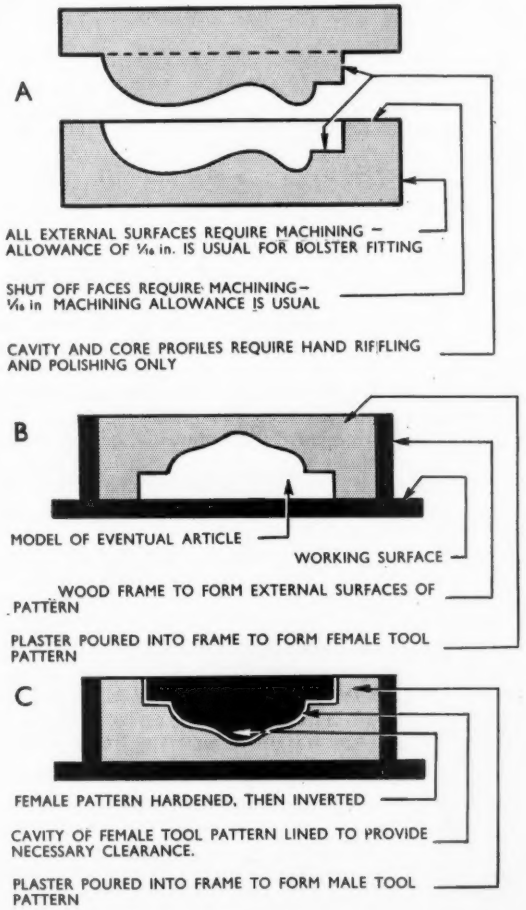
A report on a recent visit to Darwins Limited, of Sheffield, where the Truprocess technique for toolmaking was demonstrated

FOR many years the plastics industry has watched with great interest the various attempts to speed up the process of high quality mould making. Since so much of the cost of any tool is bound up in labour charges, resulting from lengthy machining operations, any technique which effectively reduces the time of manufacture makes possible a reduction in cost. The added advantage arises from this, of bringing a tool into production much more quickly, easing the tool making bottle-neck that has long been with us. The casting of metals, e.g. aluminium, brass, copper-beryllium, etc., for the production of moulds has long been carried out, but the casting of steel for this purpose has hitherto proved exceptionally difficult.

Before the desired stage could be reached, however, many complicated problems required solution; amongst these were questions of foundry practice, involving the dimensional changes, surface finish, and metal density of the steels employed. To say that each of these problems now stands permanently solved would be an exaggeration but there is today enough evidence to show that for many tools, a fast and relatively cheap method of tool making is available which has been brought to a high degree of technical achievement. The process, which will be described here, has evolved both from a study of previous attempts at tool casting and a lengthy study of metal formulations and methods of casting.

The methods of tool making by casting with which most people in the industry are familiar are: (1) The Carbon Dioxide Process; (2) Shell Moulding; (3) the Lost Wax Process; (4) the Mercast Process; (5) the Shaw Process; (6) the Investment "X" Process. The first two of the above mentioned employ washed sand, the remainder being based on superior refractory materials in the form of a slurry investment. Of all these techniques the two most well known to date are the "Lost Wax" and Mercast processes. In the former wax is employed to make the pattern, whilst in the latter frozen mercury is used. Both techniques rely on a master metal die and therefore are only economically useful when several hundreds or thousands of steel or metal castings are required.

The Shaw Process, with which we are concerned here, is a new casting technique inherently suitable for casting plastics moulds, and has been developed by Darwins, of Sheffield, to the point where already a great many tools for the plastics industry are giving excellent service. It is based on two important developments. First, the availability of ethyl silicate, also known as silicon ester, which can function as a bonding agent for quartz or natural silica at casting temperatures of 1600° C.


A
ALL EXTERNAL SURFACES REQUIRE MACHINING – ALLOWANCE OF 1/16 in. IS USUAL FOR BOLSTER FITTING
SHUT OFF FACES REQUIRE MACHINING – 1/16 in MACHINING ALLOWANCE IS USUAL
CAVITY AND CORE PROFILES REQUIRE HAND RIFFLING AND POLISHING ONLY
B
MODEL OF EVENTUAL ARTICLE
WORKING SURFACE
WOOD FRAME TO FORM EXTERNAL SURFACES OF PATTERN
PLASTER POURED INTO FRAME TO FORM FEMALE TOOL PATTERN
C
FEMALE PATTERN HARDENED, THEN INVERTED
CAVITY OF FEMALE TOOL PATTERN LINED TO PROVIDE NECESSARY CLEARANCE.
PLASTER POURED INTO FRAME TO FORM MALE TOOL PATTERN

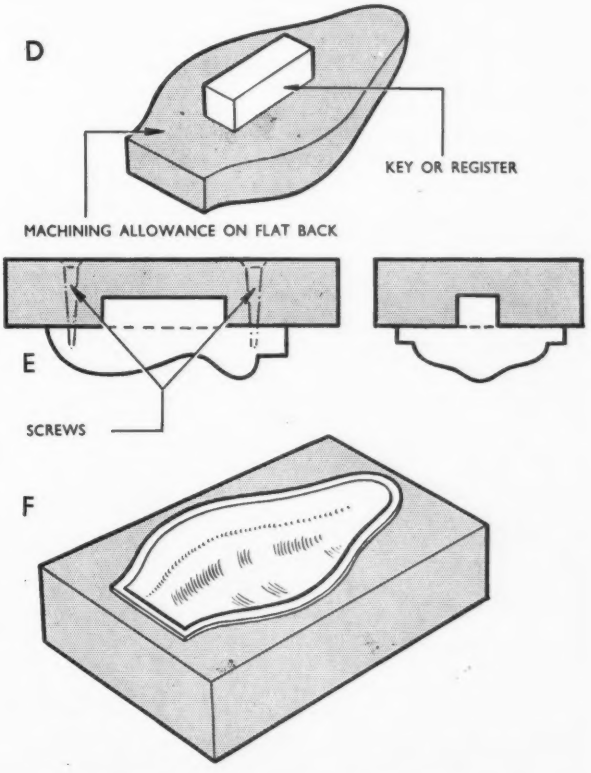


Fig. 1. Diagrammatic representation of the various stages in the Truprocess technique.

Fig. 2. Pouring the slurry to invest the pattern.

Second, the perfection, after two years research by Darwins, of moulding and casting techniques to yield the required surface finish, etc. This, linked with the Company's experience gained over many years in the manufacture of tool steels, provides the key to the success of this technique, called by Darwins the " Truprocess."

The sequence of operations involved in the " Truprocess " is as follows: (1) Provision of model of eventual plastic article; (2) investment of model with plaster of paris for production of moulding tool pattern; (3) investment of plaster pattern with refractory slurry; (4) firing and hardening of slurry mould; (5) casting steel into mould. Steps 1 and 2 may be eliminated if a moulding die pattern is constructed directly by normal pattern-making methods. We will assume, however, that an ultimate model has been provided so that as complete a picture as possible is given. The drawings in Fig. 1 help to clarify the various phases in tool manufacture.

Prototype Model

The model will, of course, govern the derived pattern and hence the finished cast tool; any imperfections on the model will be faithfully reproduced down the line of operations. It is, therefore, necessary to relate the model to the requirement in terms of cost. The more important the project, the greater should be the care in producing the model. However, clay, plasticine, plastics, wood and metal can all give very satisfactory models.

Fig. 3. Igniting the mould with a gas torch.

For best results, however, and wherever the tool cost is justified, a soft metal model should be made accurately. It is also important to note that the model must be made oversize by the amount of anticipated contraction associated with the freezing and cooling of the metal in the casting process. (For most steels this is very nearly 1 in 48 linear or about 2%.)

Production of Plaster Patterns

Hard dental plaster is a perfectly sound and well tried medium for the investment of the model. The parting line must be accurately determined, and each half of the model is then invested. The model is supported in the first instance on an " oddside " of clay, plasticine or plaster up to the precise level of the pre-determined parting line. It is surrounded by a wooden framework, the internal dimensions of which are in excess of the final machined dimensions of the eventual tool exterior. This framework must, of course, be accurately positioned to determine the location of the final die casting. A syrup of hard dental plaster is then poured over the model to the required depth and allowed to set. Whilst still embedded in the set plaster the whole job is inverted and the " odd side " removed. The exposed parting line surface may now be adjusted or corrected and after applying a parting agent to this surface a further supply of plaster syrup is poured over the now exposed half of the model and again this is allowed to set hard. In this way complementary female cavity replicas of the finished tools are produced.

Fig. 4. Firing the mould at 1000° C.

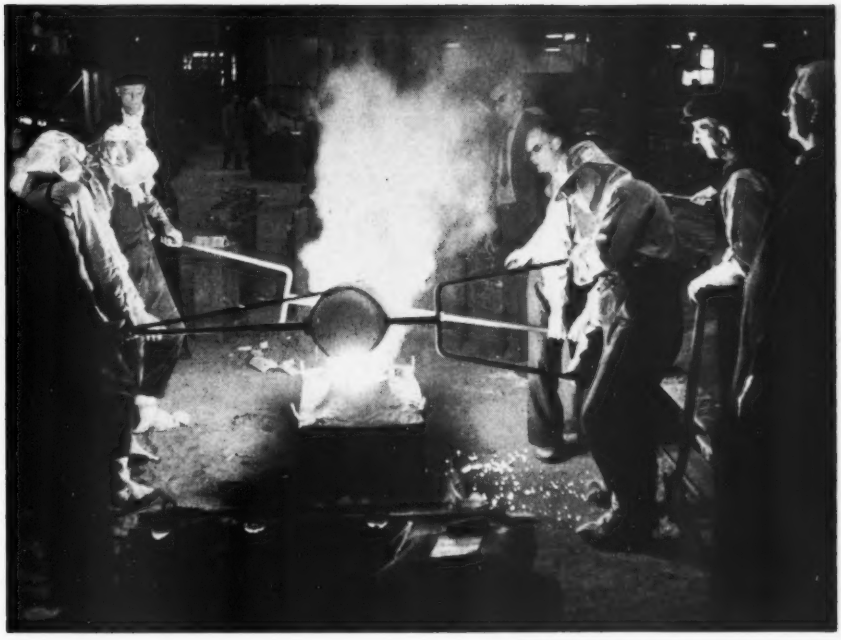


Fig. 5. Casting the metal into the mould at Darwins.

A great deal of freedom for manœuvre is possible at this stage. Thus, if next each of the cavities now created in plaster is carefully lined with soft dental wax sheet of appropriate thickness, a reduced size cavity results which when similarly charged with plaster provides the basic pattern of the male tool or punch governing the wall thickness of the plastic article.

The Refractory Mould

This is prepared from a slurry of ethyl silicate and a filler of sillimanite granules specially graded. The ethyl silicate has the especially valuable property of undergoing hydrolysis in the presence of water, yielding first a silicic acid gel, followed by silica, alcohol and water. The ethyl silicate and sillimanite are mixed rapidly into a thick slurry, the ethyl silicate having just been accelerated with a catalyst, and this is poured into the box, investing completely the plaster pattern. This process is seen in Fig. 2.

A brush is employed to spread the slurry over the surface of the pattern, thus preventing small bubbles attaching themselves to the surface which would afterwards leave minute subcutaneous holes. On completion of pouring, the mass is allowed to stand, and within a few minutes sets to the solid state, although at this point it is still slightly elastic and rubber-like. This is of advantage since it facilitates the removal of the plaster pattern.

The box containing the hardened slurry is then removed, and the mould is ignited with a gas torch (Fig. 3). The alcohol evolved burns away vigorously. It is important that it should be removed as quickly as possible since it may otherwise collect in localized pockets, causing the formation of major cracks in the mould. By rapidly burning the alcohol, an intricate maze of barely visible hair cracks is built up instead, and these, as will be seen later, are of considerable value at the casting stage.

At the end of the burning reaction there still remains in the mould a residual quantity of alcohol vapour, which must be removed. This is carried out by firing the mould in a furnace at approximately 1000° C. This operation is shown in Fig. 4. At this stage a lid is provided to the mould, containing the orifice through which the metal will eventually be poured. The lid is fixed in position by the use of additional slurry which is hardened quickly the alcohol being fired-off in the furnace.

An important point here is that the mould is capable of withstanding very high temperatures, and can in fact be made red hot so that when the metal is poured maximum fluidity is attained. In addition, the silica structure of the mould has very poor thermal conductivity, and for this reason heat loss of the molten metal is low, and cooling and solidification take place relatively slowly. This facilitates proper feeding of metal to all parts of the mould.

Casting

Casting is carried out by the normal methods employed in foundries. The metal is taken from the furnace and carried in large ladles to the pre-heated mould. The casting of a tool at Darwins' is shown in Fig. 5. After pouring, the casting is allowed to cool slowly, and only when cold is the mould broken away.

Finishing

The casting is first cleaned by a shot blasting process (air and grit), to remove any adhering silica. It is then annealed in the normal way, as would a cast billet of steel. The next process is to shot blast again, to smooth the surface, followed by treatment in an aqua-blast unit, using a composition of water and grit, designed to give an excellent finish. The casting is then ready for the final machining, finishing, and polishing operations, usually carried out by the toolmaker. The degree of finishing involved depends on the nature of the moulding to be made. Since the vast majority of "Truprocess" moulds for plastics are cast in a special composition of stainless steel, chromium-plating is found to be unnecessary. Also except for compression moulds it is not the practice to give any further hardening heat treatment, since this type of steel possesses fully adequate wear and corrosion resistance and will resist sinking under the pressures experienced in all injection or transfer moulding. Another variety of air-hardening steel is used for compression moulding where accidental hobbing hazards are present from "flash." The final operation involves mounting the mould in its containing bolster

Fig. 6. Demonstrating the fidelity of the process.

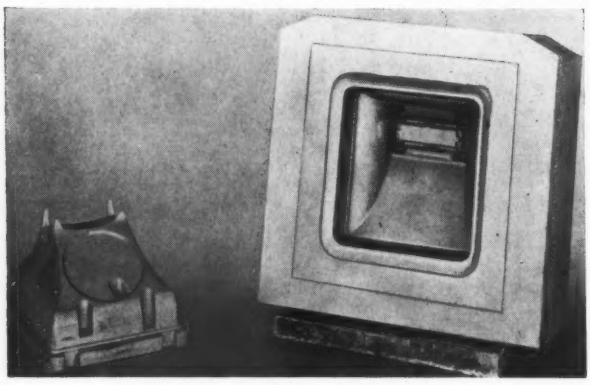


Fig. 7. Punch and die for telephone hand-set.

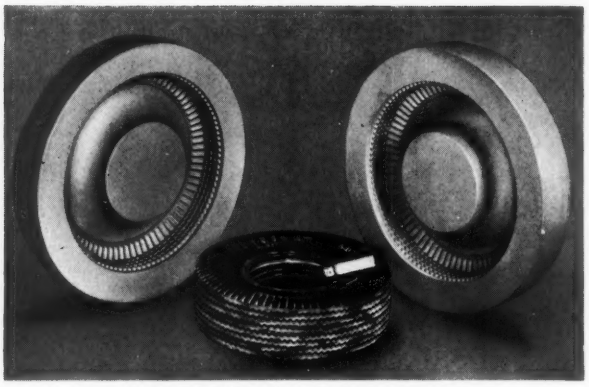


Fig. 8. Mould for miniature tyre.

or chase, the fitting of dowel pins, etc. These operations can be carried out by the tool makers, in common with the polishing, plating and other operations mentioned above.

Other Considerations

Having briefly outlined the "Truprocess," it is now necessary to examine various associated factors which will influence the large-scale development of the process. These factors are principally: types of steel, shrinkage, and cost.

Types of Steel

As research into the process advanced at Darwins, it became clear that because of the perfect reproduction obtainable, even the smallest flaw in the quality of the steel can ruin an otherwise fine casting. The slightest blemish on the face of the casting stands out in sharp relief. To obviate such flaws is no easy matter when it is remembered that in no other case is the surface of a casting, as produced in a foundry, the ultimate working surface of a component. Indeed it is traditionally accepted that any minor impurity in the steel will move, in the pouring process, to the outer side of the casting, and that a certain quantity of the surface metal is automatically machined away.

Realizing the serious nature of the problem, Darwins initiated a separate programme of research to improve the cleanliness of steels, and to examine the various aspects of steel melting and pouring so as to be able to control cleanliness and ensure blemish-free castings. As a result of this, such faults as globules of trapped slag, dislodged particles of refractory materials, small surface pinholes, etc., are now rare occurrences.

As a result of these successful refinements in steel making, steels of all kinds can be used in the manufacture of tools for the plastics industry, depending upon the customers' requirements. Stainless steel for p.v.c. moulding, hot work steels, and many others can be employed with complete freedom as needed.

Shrinkage

Although steel shrinkage is a pre-determined factor in terms of volume, it is unfortunately a fact that during the pouring process, shrinkage does not always take place in a uniform manner. This is, of course, particularly noticeable when the shape of the casting varies widely in its cross-section. This can give rise to errors which at first sight might make the process useless for the manufacture of large moulds. An error of .005 in. on 1 in. is perhaps tolerable, but that error on a 6-in. section becomes .030 in., and .120 in. on 24 in. Fortunately an allowance of .005 in. per inch is substantially in excess of that normally encountered.

In practice, therefore, it is found that rarely is it impossible to meet the specification. One important factor which helps is the ease with which a machining allowance can be made in the mating surfaces of two halves of a tool, and the type of machining necessary here is relatively inexpensive, involving the milling of plane surfaces.

Cost

The prime factor in the cost of cast tools is the saving in labour charges due to the elimination of a tremendous amount of machine shop work. This is reflected in the time taken to make a cast tool when compared with an identical tool made by conventional methods—at its lowest, 50% of the latter. We may, therefore, expect to see significant reductions in tool charges where the "Truprocess" is adopted. In addition, we may expect to see a relieving of the present bottle-neck in tool making and eventually the concentration by the skilled craftsmen on the manufacture of tools too complex to be made by the "Truprocess," or in the finishing and polishing of "Truprocess" tools.

ISO/TC 61—Plastics

THE sixth meeting of ISO/TC 61—Plastics, was held at The Hague from September 17 to 22, 1956. The countries represented were: Belgium, Czechoslovakia, France, Germany, *Hungary, India, Italy, Netherlands, *Poland, *Rumania, Sweden, Switzerland, United Kingdom, U.S.A., *U.S.S.R.

International bodies represented by observers were the International Electrotechnical Commission and the International Union of Pure and Applied Chemistry. The American Standards Association are the Secretariat of ISO/TC 61. The Chairman of the meeting was Dr. G. M. Kline (U.S.A.) and the Co-Chairman Mr. D. J. van Wijk (Netherlands).

Comments were considered on nine draft ISO proposals circulated following the 1955 Paris meeting. The nine proposals are:

Determination of flexural properties of rigid plastics.

Determination of bulk factor of moulding materials.

Detection of free ammonia in phenol-formaldehyde mouldings.

Determination of styrene in polystyrene with Wijs solution.

Determination of viscosity number of polyvinyl chloride resins in solution.

Determination of melt flow index of polyethylene and polyethylene compounds.

Determination of resistance of plastics to chemical substances.

Determination of volatility of plasticizers from plastics.

Determination of migration of plasticizers from plastics.

The first draft ISO proposal for a list of plastics equivalent terms had also been circulated in July, 1956.

Five draft ISO recommendations had been sent by the General Secretariat in Geneva to member bodies for consideration for advancement to the status of ISO recommendations. They are:

Determination of acetone-soluble matter of phenolic mouldings.

Determination of apparent density of moulding powders which can be poured from a funnel.

Determination of apparent density of moulding powders which cannot be poured from a funnel.

Determination of water absorption.

Determination of temperature of deflection under load.

* Represented for first time.

New Productions

Protected Fume Cupboard Fans

The method of protecting fans against corrosive gases by a coating of polythene, developed by Woods of Colchester Ltd., is now applied to Aerofoil fans designed for fume cupboards.

As for other applications, the axial flow design has advantages for fume cupboard extraction. Inserted directly into straight ducting, it enables exhaust systems to be kept simple and compact.

The new fume cupboard fans, made in three sizes, 6 in., 7½ in. and 9½ in. diameter, are completely protected with polythene inside and out. The motor and casing are hermetically sealed in a covering which is resistant to practically all corrosive reagents. To ensure adhesion of the polythene to the fan the casing is made from perforated steel and is coated on both sides. Thus polythene passes through the perforations, joining the inner and outer coatings, and as a result the metal is sheathed within a homogeneous double skin.

The fan impellers are phenolic mouldings, inherently resistant to corrosion, and the hubs are designed to shield against the ingress of fumes into the motor through the spindle bore.

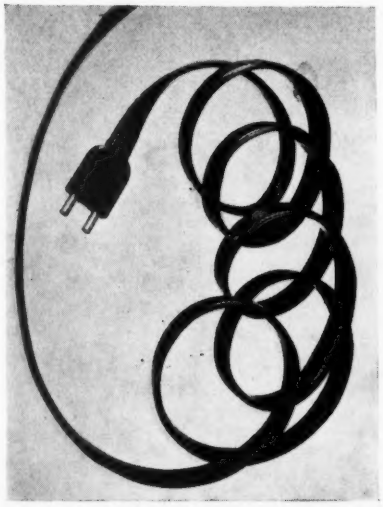
Flexible Heater Tape

Thomas French & Sons, Ltd., of Chester Road, Manchester, 15, recently introduced their new Vesta flexible heater tape.

This is a narrow tape comprising a resistance wire interwoven with glass fibre—resulting in an element of the greatest structural strength and high insulating properties—with a black plastic covering.

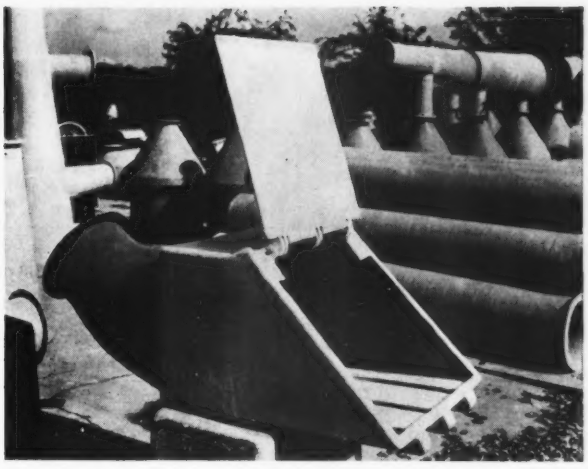
Both for industrial or domestic use the Vesta heater tape is connected to a 2-pin plug; thermostatic control is available. The resistance wire is nickel, nickrome, eureka, stainless steel or any special alloy or combination for specific purposes.

The insulating medium is glass fibre with extruded p.v.c. coating for temperatures under 176° F./80° C. or 30% dispersion of silicone silastomer for temperatures under 454° F./260° C. under wet conditions.



(Left) Vesta flexible heater tape with p.v.c. covering for temperatures up to 80° C.

(Right) Plating barrel manufactured from Paxolin fabric laminate by Micanite & Insulators Co. Ltd. There are approximately 500 1 in. diameter holes in this 22½ in. long barrel.



Chute head, ducting and cowls manufactured from glass reinforced polyester and epoxide resins by Mendip (Chemical Engineering) Ltd.

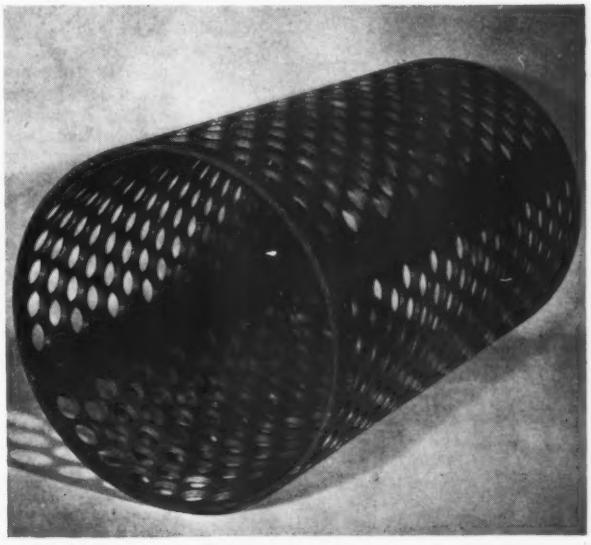
Printed Circuits in Sub-Miniature Radar Receivers

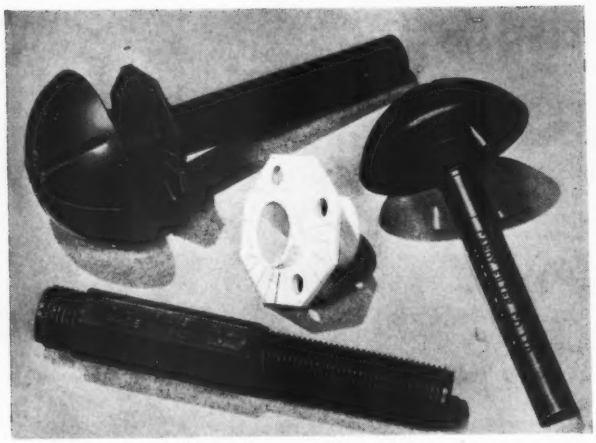
The compact design of a sub-miniature radar receiver recently introduced by Elliott Brothers (London) Ltd., Boreham Wood, is due to the fullest use of printed circuit techniques. The receiver comprises six replaceable plug-in units, five of which are made with all components on one side of a Bakelite copper-clad laminated sheet, the etched circuit, including gold-plated etched plugs, being arranged on the opposite side to allow connections to be made by dip soldering. Where valve wires are to be connected, small eyelets have been inserted into the board so that if a valve change is necessary at a later date, no damage can occur to the copper foil due to careless hand soldering.

One of the main features of the receiver is the use of printed circuit sheet connections at the rear of the sockets. This demonstrates that dip soldering or automatic soldering techniques can be as readily applied to these interconnecting points as to the individual replaceable units.

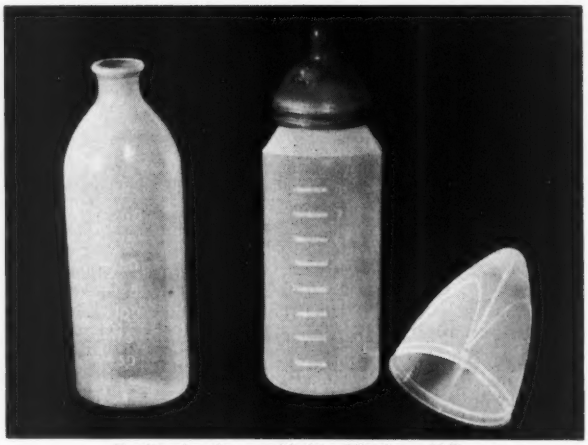
New Laminates for Chemical Plant

Chemical plant is now being fabricated by Mendip (Chemical Engineering) Ltd., Feltham Road, Ashford, Middlesex, from compound laminates made from Bakelite epoxide and polyester resins reinforced with glass fibre materials. The new laminates offer several advantages compared with conventional materials used in the construction of chemical plant, and one of these features is their excellent chemical resistance, which enables them to be used for a wide range of purposes. Other properties, such as abrasion resistance, can be heightened, if required, to meet particular conditions. In addition, the high strength/weight ratio of the laminates means that structures made from them are light in comparison with other materials and hence less labour and effort is required during installation. Finally, the use of compound laminates provides considerable freedom of design and enables structures of complex shape to be produced which could not be readily achieved in other materials.





Moulded polystyrene filter nozzles.



Feeding bottles moulded in Alkathene H.D.

Water Filter Nozzles

The efficiency of rapid gravity water filters built by The Candy Filter Co., Ltd., has been considerably increased by the fitting of nozzles of high impact polystyrene instead of copper alloy.

Screwed into the concrete base of the filter bed, they are used for scouring and cleaning the sand with compressed air and high pressure water.

Moulded by Lorival Plastics of Little Lever, near Bolton, Lancs., the new polystyrene nozzles are required to withstand exceptionally arduous conditions.

Surrounded by shifting sand, they must be so resistant to erosion that the orifices, through which pass air and water, remain constant in size. Great mechanical strength is also needed to withstand distorting effects and the weight of the men laying the bed.

Perhaps the most important requirement, however, is resistance to the chemical action of water with high acid or alkaline content. In certain regions, the problem of corrosion was such that special nozzles in expensive materials like stainless steel were formerly specified.

Laid in rows 6 in. apart and spaced at 6 in. intervals, the nozzles screw into polystyrene bushes set in the concrete floor—their stems connecting with compressed air and water pipes below the surface.

Though similar in appearance to the former copper alloy nozzle the " petals " of the polystyrene version are linked for added strength and resistance to distortion.

Terylene Protective Clothing

Eight different articles made from Terylene polyester fibre are used in H.M.S. Excalibur, a new type of submarine propelled by High Test Peroxide, and similar articles manufactured from Terylene are used to handle the fuel for rockets propelled by H.T.P.

Though not itself inflammable, when in contact with dry organic materials such as wood or natural fibres, oxygen is liberated and the heat so generated can lead to spontaneous combustion. In co-operation with the Admiralty and the Ministry of Supply, a number of firms have developed suitable equipment, such as hoses, and protective clothing for personnel, for handling H.T.P.

A range of Terylene hoses, lined and coated with a special plastics material formulated by the Admiralty Materials Laboratory, has been developed by Compoflex Co. Ltd. of London. This same company has also developed a range of Terylene gaskets for use with H.T.P.

The engine room crew of the H.T.P. propelled submarines are fully equipped with Terylene protective clothing. One-piece overalls and separate hoods, together with Terylene long underpants and singlets, are supplied to the crew. The overalls and hoods, in a silicone-proofed, vapour-permeable Terylene by Fine Spinners and Doublers Ltd. are made up to Admiralty specifications by M. Barr and Co. Ltd. of Glasgow.

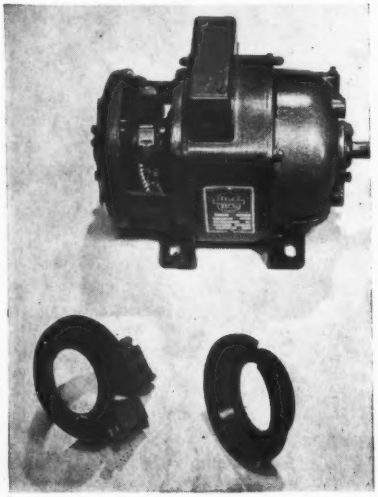
For handling and pumping H.T.P. on shore, both for submarine and rocket use, special protective clothing has been developed in Terylene by such firms as R.F.D. Co. Ltd. of Godalming, Siebe Gorman Co. Ltd. of Surbiton and M. Barr and Co. Ltd. In addition, Glove Industrial Ltd. manufacture Terylene protective gloves for handling H.T.P. All the protective clothing is sewn with Terylene thread.

Alkathene H.D. Feeding Bottles

By using the new high density polythene produced by I.C.I. these feeding bottles can be sterilized in boiling water without distortion or ill effects. They are also unaffected by all domestic chemicals. Both bottles are produced by Fibrenyle Ltd., 157 Dukes Road, Western Avenue, London, W.3, and are an addition to the Skylon range manufactured by this company. The bottle on the right with its wide neck can be used both as feeding bottle and as a measure to prepare food.

Moulded Dynamo Components

Mica-filled Rockite phenolic moulding material manufactured by British Resin Products Ltd. is now being used by Lancashire Dynamo & Crypto Ltd. for moulding the brush carrier illustrated. Besides its excellent electrical properties and low moisture absorption figure this material has good mechanical strength and exceptional stability after the initial shrinkage on moulding. All these properties are of considerable importance in this application.



(Left) Mica-filled phenolic mouldings for a dynamo brush carrier.

(Right) An occasional table incorporating in the Formica top, a design based on a mechanical tint to form an enlargement of a natural flower.

Plastics News

Plant and Equipment, Materials, Processes, Company News, Technical Literature, Exhibitions, Personal Notes and Meetings.

BOTTLE BLOWING PRESS.—Following last month's announcement that Warbrick (Engineering Specialties) Ltd., Barclays Bank Chambers, Sankey Street, Warrington, Lancs, have become the British representatives for the Blast-Press we now give further details of this press.

The main frame is of braced 20 mm. plate. At each end are the two cylinders giving the hydraulic pressure for closing the moulds, supplied from a hydro-pneumatic system. The two moving platens are mounted on two bars, one on each side of the machine, which travel with the platen and are supported by sleeve fittings. The position of the platen on these bars can be adjusted by releasing the locking nuts. The two compressed air nozzles for forming the bottle can be adjusted to blow either from the top or bottom of the mould or from both. The air supply is controlled by a switch operated by the closing of the platen. The platen movement is controlled by a lever at the front of the machine which closes the one mould and opens the other thus giving a continuous production cycle.

The press can be fed from pre-cut extruded tube suitably pre-heated or direct from the extruder providing sufficient heat is retained in the plastic.

The maximum size which can be blown is a 5 litres container and depending on the size being produced a capacity of 120 per hour can be maintained.

HIGH-POWERED PLASTIC PRE-HEATERS.—Radio frequency plastic pre-heaters of up to 20 kW. output and over have been available in America for some considerable time past where they are very popular. In this country, plastic presses in general open and close quite slowly, with the result that it is not usually practical to preheat plastic moulding powder to high temperatures without the risk of pre-curing. In the United States, it is now apparently regarded as normal to preheat plastic moulding powder to a temperature of 250° F. whilst a large number of companies commonly preheat to 300° F, and one at least (Delco-Remy) is understood to be preheating up to a temperature of 350° F.

These very high preheating temperatures naturally considerably increase the productivity per operator in the moulding shop. They do, however, also demand very high rates of powder preheating. These high rates of powder preheating can only be achieved on high-powered plant.

To meet the demand in the export market for such high-powered plant, the new Radyne 20 kW. plastic preheater has just been introduced. The equipment, Model H.180, is certified by the makers to meet the United States F.C.C. Interference Laws, and the equipment also meets the German F.T.Z. certification requirements.

The performance of the equipment on different loads of powder is given below.

Weight of Pellets	Heating time in seconds		
	90°C.	110°C.	130°C.
1 lb. (0.46 kg.)	15	20	25
2 lb. (0.92 kg.)	15	20	25
4 lb. (1.84 kg.)	26	35	45
8 lb. (3.66 kg.)	45	55	70
16 lb. (7.35 kg.)	90	110	—
*24 lb. (11.0 kg.)	130	150	—

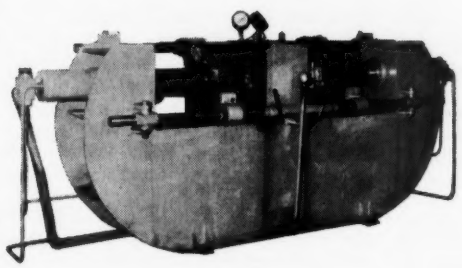
* The 24 lb. (11 k.g.) load was heated with 17 in. × 21 in. (43 cm. × 53 cm.) electrodes; all other loads with 14 in. × 18 in. (36 cm. × 46 cm.) electrodes.

The new Radyne range of plastic preheaters is being introduced into the United States, and Radyne preheaters will be on display at the Pacific Plastics Exhibition in California.

It has already been ascertained that it is common in America to use preheaters of approximately ten times the rating per lb. of powder which is used in this country. In other words, where a ½ kW. preheater would be used in Great Britain, a 5 kW. unit would commonly be used in the United States for the same load of powder.

General

Design Award.—A "Golden Compasses" design award which is given by the Italian store La Rinascente has been awarded to a polythene bucket designed by Robert Menghi and produced by Smalterie Meridionali.



The Blast-Press for bottle blowing recently introduced into this country by Warbrick (Engineering Specialties) Ltd.

The new high-powered preheater manufactured by Radio Heaters Ltd., Wokingham, Berks.

Cementing p.t.f.e.—Hydralon Ltd., Millbrook Industrial Estate, Southampton, have recently produced a p.t.f.e. tape which can be bonded. One surface of the tape is chemically treated to enable adhesion to occur. Cold setting expoxy resin glues are recommended but other adhesives can be used and give satisfactory results. Further details can be obtained from the manufacturers.

High Speed Stroboscope.—Preliminary information has been released by the manufacturers of a new high speed electronic stroboscope. This is an addition to the existing range of stroboscopic devices and covers the range 7,000 to 40,000 flashes per minute on fundamental; but by using up to the fourth harmonic enables observation to be made up to 160,000 r.p.m.

The instrument, which is mains driven, is manufactured by Dukes & Briggs Engineering Co., Ltd., of Altrincham, Cheshire.

Vacuum Forming Machinery.—The Atlas Vacuum Corporation of 367 Orchard Street, Rochester, New York, announces the production of a new laboratory model vacuum forming machine.

The model "A–14" has a forming area of 14 in. × 14 in. and can drape draw up to 6 in. The entire unit runs on 110 v. electricity and can be operated from a standard wall outlet.

National College Prize-Giving. Dr. R. H. Melville, secretary of the Department of Scientific and Industrial Research, presided over the annual presentation of awards at the National College of Rubber Technology on February 28. Attended by members of the governing body and teaching staff, Dr. Melville also toured the laboratories and workshops of the college, and examined some of the apparatus now employed in fundamental research into high polymers.

12 Mile Pipe-line. Shell Petroleum are reported to be considering the use of plastics in the manufacture of a 12 mile pipe-line from

The Carl Zeiss automatic camera microscope.

the new tanker docks at Tranmere, Birkenhead, to the Stanlow refinery. This is only one of many developments involving plastic piping at present under review by the oil industry.

Camera Microscope with Automatic Exposure Mechanism.—A new automatic camera microscope with wide scientific, medical and industrial applications will shortly reach this country. Known as the Ultraphot II, it is made by Carl Zeiss of Western Germany. The instrument is suitable for visual observation as well as photomicrography and in addition it can be used for microprojection on to a ground glass screen, making it particularly valuable for instructional purposes. For metallurgical work special wide-angle objectives for survey photography are available.

An outstanding feature of the Ultraphot II is the fully automatic photographic mechanism, which entirely eliminates the difficulties of computing exposures in photomicrography. These difficulties, particularly pronounced in colour work, demanded a considerable technical skill which is unnecessary with this new instrument. A single push button opens the camera shutter and the exposure time is then adjusted automatically to the correct value for the intensity of illumination. The shutter closes automatically after the correct exposure.

Bright field and dark field methods and phase contrast technique with either trans- or epi-illumination, employing polarized or non-polarized light, may all be readily used.

The United Kingdom agents are Degenhardt & Co., 32 Maddox Street, London, W.2.

Trimethyl Aluminum is being produced by U.S. Industrial Chemicals Co. in pilot quantities. A highly flammable liquid which ignites spontaneously in air, trimethyl aluminum is being tested as a fuel and it also has possible application as a polymerization catalyst.

Also available from the pilot plant is methyl aluminum sesquichloride, a mixture of methyl aluminum dichloride and dimethyl aluminum chloride.

The Plastics Institute.—An extraordinary General Meeting of the Members of The Plastics Institute Limited will be held at 6 p.m., on Monday, March 18, 1957, in the Lecture Hall of the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1, for the purpose of considering and, if thought fit, passing two special resolutions.

Union Carbide take over Visking.—Approval of the purchase of the assets of The Visking Corporation by Union Carbide and Carbon Corporation was voted by Visking stockholders at a special meeting. It became effective from December 31, 1956.

Literature

Unpublished Reports.—Copies of the following reports can be borrowed on application to D.S.I.R., Technical Information and Documents Unit, Cunard Buildings, 15 Regent Street, London, S.W.1.

Infra Red Spectra of Plastics and Resins.—PB.111438. Based on transmittance curves, given for 57 representative synthetics over the 2–15 micron range, a fairly simple guide is devised for identifying an unknown material from its spectrum.

The Friction and Lubrication of Nylon.—PB.111510. The friction coefficients of nylon on nylon and of steel on nylon were determined on a Bowden-Leben-type " stick-slip " machine, using 16 purified lubricants of widely varying adsorption power.

Coefficient of Thermal Expansion and Water Sorption of Polymethyl Methacrylate.—PB.116588. This paper reports a series of studies of water sorption of polymethyl methacrylate as influenced by: (*a*) the addition of filters, (*b*) cross-linking the resin, and (*c*) change of pH of the water.

Development of Transparent Materials which reduce effects of Precipitation Static in Aircraft.—PB.118281. Methods of laying a transparent electrically conductive film on plastic aeroplane canopies are discussed.

Development of Methods for predicting the service life of Organic Coatings for Aircraft.—PB.114680. The object of this work was to develop a non-destructive test which would indicate the useful life that remains in a specified protective coating on a metal surface.

Engraving on Coated Vinylite.—PB.118033. Engraving on vinylite affords the most rapid, precise, and efficient method at present available for preparing colour separations for map and chart reproduction, and vinylite is an excellent substitute for the glass base negatives normally used for this purpose.

Strippable Coating. Application and Maintenance.—PB.852554. This report gives details of a suitable coating, its properties, uses, and methods of application. It describes in detail the equipment used and provides instructions on its use.

The Branching Reaction and Chain Transfer in Styrene Polymerization.—PB.118440. In addition to the three basic steps of initiation, propagation, and termination, polymerization can be effected by transfer reactions. This report presents data on the chain transfer activity of t-butyl mercaptan, t-butyl alcohol, isopropyl cyanide, and isopropyl alcohol, indicating that it is the hydroxyl hydrogen in the t-butyl alcohol which undergoes chain transfer.

Institute of Polymer Research.—PB.114390. Work covered by this report comprised, in particular, further molecular characterization of polyvinyl butyrals and acetates, including studies by hydrolysis and reacetylation, and absorption experiments.

Institute of Polymer Research.—PB.114559. In work covered by this report, two polyvinyl acetate samples of weight average molecular weights of 85,000 and 190,000 respectively, possessing a wide molecular weight distribution, but presumably a low degree of branching were found to have increased their molecular weights by factors of 2–3 when converted into formals.

Tinplate Handbook.—A new and enlarged edition of this handbook has been published by the Tin Research Institute and is available free of charge to all interested in the manufacture, buying and use of tinplate.

New Designs in P.V.C. Coated Fabric.—Several attractive and new designs have been added to the Rydura range of coated fabrics manufactured by Ryjack Productions Ltd., 89 Oxford St., Manchester 1. As well as bright plain colours several contemporary designs have been introduced.

PLASTICS INDEX

The index for Volume 21, January to December 1956 of *Plastics* is now in print. Copies can be obtained from Temple Press Ltd., Bowling Green Lane, London, E.C.1, price 4d. to cover postage and packing.

Company News

Midland Silicones Ltd.—The north-eastern area sales office of Midland Silicones Ltd., has moved from its former address to more extensive premises at 5/7 New York Road, Leeds, 2. Telephone number Leeds 26768.

Blythe Colour Works Ltd.—The directors of Blythe Colour Works Ltd. recommend a final dividend on ordinary shares of 6d. per share actual, less income tax.

Shell Chemical Co., Ltd.—It is announced by Shell Chemical Co., Ltd., that all head office departments, with one exception, are now located in the Company's new building at Marlborough House, 15/17 Great Marlborough Street, London, W.1. The telephone number is Gerrard 0666.

The plastics and resins department will remain at the Company's present address, Norman House, 105/9 Strand, W.C.2.

British Hydrocarbon Chemicals Ltd., announces that its two new plants for the production of ethylene and ethanol have been successfully brought into commercial operation, and have doubled the existing capacity for these basic chemicals. British Hydrocarbon Chemicals Ltd. is jointly owned by The British Petroleum Co., Ltd., and the Distillers Co., Ltd.

Mentmore Manufacturing Co., Ltd.—The Plastics Division of the Mentmore Manufacturing Co., Ltd., has moved to Stevenage New Town. The new address of the Plastics Division is Six Hills Way, Stevenage, Herts., Telephone Stevenage 1701,

Rubber Improvement Ltd.—The Annual Dinner and Ball of Rubber Improvement Ltd. was held at Rilex Canteen, Wellingborough, on Friday, February 1. The function was attended by 350 of the Company's staff and guests.

Mr. Alan R. Milne, of I.C.I. Fibres Division, proposed the toast to the Company, referred to its achievement as a success story. Mr.

Lewis, Chairman, in reply stated that the firm received strength and backing from that great organization I.C.I. Ltd.

Mr. W. J. Reynolds, sales director, welcomed the visitors and ladies. Mr. George S. Lindgren, M.P. for Wellingborough, replied on their behalf.

U.A.M. Plastics Ltd.—The U.A.M. Group announces the formation of U.A.M. Plastics Ltd. as a wholly-owned subsidiary of the parent organization, The Universal Asbestos Manufacturing Co., Ltd. The new company is to make glass fibre reinforced plastics materials based on polyester resins, for which purpose rights have been acquired in a new system of manufacture. The plant will be installed in a new building at the U.A.M. Watford works, where construction is already in progress. Production of corrugated translucent sheets will begin this summer; other applications may be developed in due course.

Charles Delderfield Ltd., of 88 Farringdon Street, London, E.C.4, are pleased to announce they have been appointed Sole Agents for the United Kingdom for The Wren Paper Company, Middletown, Ohio, makers of the highest grades of Saturating Base and Alpha and Rayon overlay papers for Laminated Plastics.

Wild-Barfield Electric Furnaces Ltd., of Elecfurn Works, Otterspool Way, Watford By-Pass, Watford, Herts., are pleased to announce that they have concluded an agreement with Paul Ferd. Peddinghaus of Gevelsberg, Germany, the well-known manufacturers of flame hardening equipment. By the terms of the agreement, Paul Ferd. Peddinghaus are appointed sole agents for the sale and service of Wild-Barfield A.H.F. Induction Heating Equipment in Germany, and Wild-Barfield have the right to use Peddinghaus designs of handling fixtures for use on induction heating applications where applicable.

The Du Pont Co. (United Kingdom), Ltd., announce that having received necessary approvals of Bank of England and Capital Issues Committee as to financing, it has decided to proceed with construction of the Neoprene synthetic rubber plant in Northern Ireland, indicated last November by the proposed acquisition of a tract of land near Londonderry. Start of construction is scheduled for mid-1957.

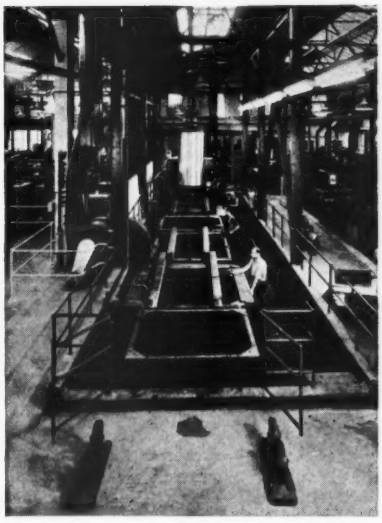
The British Oxygen Co., Ltd., announce that its subsidiary company, Carbide Industries Ltd., has arranged to purchase a site of 50 acres near Londonderry, Northern Ireland, contiguous to the Du Pont Co. (United Kingdom), Ltd.

Nettle Accessories Ltd., Harper Road, Wythenshawe, announce that they have decided to form a new company to deal exclusively with festoon lighting equipment and striplight cable. The new company, D.R. Illuminations Ltd., is located at Leestone Road, Wythenshawe, Manchester, 22, and all future inquiries and orders (other than export) should be sent to this address.

Chemidus Plastics Ltd.—This company's administrative and sales offices are now at Dominion Buildings, South Place, London, E.C.2. Telephone number Monarch 0131.

Institution of Incorporated Plant Engineers have moved their head office to 12 The Parade, Solihull, Warwickshire. Telephone No. Solihull 1111.

Robert McArd & Co., Ltd., declared a final dividend of 25% less tax for the year ending December 31, 1956. This makes a total dividend of 35%.



The new heavy chromium deposition plant installed at the Port Glasgow works of Fescol Ltd. The component being treated is a film drying drum.

Whiffen & Sons, Ltd., Fisons Pest Control Ltd. (Overseas Dept.), Fisons Chemicals (Export) Ltd., have moved their offices to Fison House, 95 Wigmore Street, London, W.1. Telephone number Welbeck 5500.

G. A. Platon Ltd., 323a Whitehorse Road, Croydon, Surrey, is a new company formed to provide a technical sales service to all industries concerned with the handling of fluids.

Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, have been appointed sole agents in the United Kingdom for the range of automatic machinery for the cold production of bolts, screws, etc., manufactured by Peltzer & Ehlers of Krefeld, Germany.

Conferences

World Congress on Scientific Management.—Mr. Henry Luce, Lt. Col. L. F. Urwick and Mr. John Diebold will be among the leading speakers at a conference for senior executives of 27 countries to be held in Paris this year from June 24–28. This will be the XIth International Management Congress to be held by the International Committee for Scientific Management, the international management organization represented in Britain by the British Institute of Management.

International Congress of Surface Activity.—The second international congress of Surface Activity, has been arranged to take place in London from April 8–12, 1957.

The President of Honour is Lord Brabazon of Tara and Sir Eric Rideal, F.R.S. is President. The Organizing Committee, of which Dr. L. H. Lampitt is Chairman, includes wide representation covering both industrial and academic interests.

A very comprehensive programme of lectures has been arranged by a committee under Dr. J. H. Schulman, head of the Department of Colloid Science at Cambridge University. Authors of these papers come from 18 countries and the subjects cover the full field of surface activity. A programme of works visits has been arranged by a committee under Mr. M. K. Schwitzer, and a reception and a banquet have been organized.

The membership fee for the Congress is £4 and application forms or further details may be obtained from any member of the committee or from the Hon. Secretary, 2nd International Congress of Surface Activity, 14 Belgrave Square, London, S.W.1.

Automation.—" Automation in the Smaller Business " is the title of a lecture illustrated by two 25-minute films to be given by Mr. John A. Sargrove, Technical Director of Automation Consultants and Associates Limited, who will address a joint meeting of The Institute of Commercial and Industrial Managers and The Institute of General Managers, London Branches, in the Charing Cross Hotel, London, on Tuesday, April 16, 1957, at 7 p.m.

Non-members wishing to attend this meeting should apply for tickets or further particulars to C. J. Hatter, A.C.I.M., A.C.I.S., Hon. Secretary, London Branch I.C.I.M., 38 Chalkhill Road, Wembley Park, Middlesex. Telephone Arnold 8863.

Plastics Symposium.—Under the auspices of the Plastics and High Polymer Division of the Internation Union of Pure and Applied Chemistry a symposium on " The relationship between physical chemistry and standardization of elastomers, fibre, and plastics in relation to their structure " is being held in Paris on July 25 and 26, 1957.

Further information can be obtained from the Secretary, Prof. Pierre Dubois, 292 Rue Saint-Martin, Paris 3.

Young People's Lecture.—There was a record attendance of about 400 young people for the Plastics Institute's Third Christmas Lecture, held at Church House. The Lecture was delivered in the Hoare Memorial Hall, where from time to time during the last war the House of Commons sat. Mr. J. Butler, A.M.I.Mech.E., F.P.I., took as his subject, " Plastics and the Engineer."

Oil and Colour Chemists' Association Conference.—The Conference will take place at Torquay from Tuesday, May 21, to Saturday May 25, 1957. Most members will be accommodated at the Palace Hotel, where the technical sessions, under the general title " Catalytic Processes Relating to the Surface Coating Industries," will be held. Non-members of the Association wishing to obtain registration forms and any other information should write to the General Secretary, R. H. Hamblin, M.A., Oil and Colour Chemists' Association, Memorial Hall, Farringdon Street, London, E.C.4.

Exhibitions

Gift Fair.—The first fair to be held in London will take place from May 13 to May 17 and will be held at Alexandra Park.

Zagreb Spring Fair will be held from April 13 to 23. Currency has been allocated by the Jugoslav Government for the purchase of, among other things, plastics and rubber goods.

Minibition at Folkestone.—The eighth in the annual series of Minibitions organized by the Purchasing Officers Association, and held con-

currently with its national conference, will take place at the Hotel Metropole, Folkestone, from September 26 to 28, 1957.

Personal

Mr. Frank Rowe, has been appointed a Director of The George Cohen 600 Group Limited—the holding company which controls the 600 Group.

Dr. J. S. Gourlay, has been appointed chairman of the Paints Division of I.C.I.

Mr. A. W. Stones has been appointed manager of the western district of the British Oxygen Gases Limited, at Birchgrove, Cardiff. He takes the place of Mr. J. E. Clark, who has accepted an appointment with British Oxygen Wimpey Limited.

Dr. Ronald Holroyd, director in charge of research, has been elected a Deputy Chairman of Imperial Chemical Industries Limited in place of Mr. A. J. Quig, who is retiring after nearly 50 years' service with the Company and its predecessors.

Mr. E. E. Haddon has been appointed Director of Chemical Defence Research and Development in succession to Mr. A. E. Childs, who has retired.

Mr. G. C. Graver presented a paper entitled "Publicity for Technical Products," to the London Section of the Institute of the Rubber Industry. This was the first paper in the re-introduced I.R.I. Sales Meetings.

Mr. D. Shane has been appointed assistant sales manager of Columbian International (Great Britain) Ltd.

Mr. J. E. Oram has been appointed managing director of Wild-Barfield Electric Furnaces Ltd.

Col. Sir William Charles Fenton, M.C., J.P., chairman and managing director of British Belting and Asbestos Ltd., Cleckheaton, has been nominated by the Council of the Textile Institute as vice-president of that body.

Mr. John Jarrett, who joined the Plastics Method and Design office of E. K. Cole Ltd. three years ago, has been awarded the Hele-Shaw National Certificate Prize and Medal for 1956.

Mr. R. H. Sturm.—It is with deep regret that we hear of the death of Mr. R. H. Sturm on February 8, 1957, in his 55th year.

Mr. Sturm, who was a Director of Compra Plastics Ltd., a subsidiary of Cosmocord Ltd., was well known throughout the industry for his work in the plastics field.

Mr. W. H. Rogers has been appointed Industrial Sales Manager of British Oxygen Gases Limited.

Mr. H. W. Graesser-Thomas.—It is with great pleasure that we hear of the election of Mr. H. W. Graesser-Thomas, of Yorkshire Tar Distillers Ltd., as Renter Warden to the Worshipful Company of Horners. Mr. Graesser-Thomas's election to this honourable rank will give considerable pleasure to our readers in that it cements the association between this ancient Company and the plastics industry even more firmly.

Mr. Graesser-Thomas was one of the founder members of the Federation and was on the council in its early years. He became vice-chairman in 1939 and was chairman from 1944 to 1946. In 1947 he became President of the Plastics Institute, a post which he held until 1950, and in 1951 was made a Fellow.

Mr. J. E. Furley.

Mr. J. E. Furley has been appointed publicity manager of E. K. Cole Ltd. Mr. Furley, who has been Ekco assistant publicity manager since 1952, joined E. K. Cole Ltd. in 1932.

Mr. H. H. Lusty.—At a recent Council meeting of the Incorporated Advertising Manager's Association, Mr. H. H. Lusty, Manager, Publicity Department, Metropolitan-Vickers Electrical Co., Ltd., (recently of Bakelite Ltd.), was elected a Fellow of the Association.

Dr. F. M. Herzberg, Managing Director of Hornflowa Ltd, was presented with a television set from his colleagues on the Board on the occasion of his seventieth birthday last month. A silver sugar castor from the senior officials of the Company was presented at a Christmas luncheon in honour of the same occasion.

New I.C.I. Directors.—The following appointments have been made to the Board of Imperial Chemical Industries Ltd.: Dr. R. Beeching becomes Technical Director; Dr. J. Ferguson becomes Research Director; Mr. L. H. Williams becomes Director in charge of Group B—Dyestuffs and Pharmaceuticals (effective from April 1, 1957, on the retirement of Mr. P. K. Standring); Mr. C. M. Wright becomes Development Director.

Two changes on the Main Board of I.C.I. are also announced: Mr. J. L. S. Steel has been appointed Economic Planning Director, and Mr. C. Paine, previously Development Director, succeeds Mr. Steel as Group A (Heavy Chemicals) Director.

Mr. E. H. Sharp has been appointed Manager of the recently formed Plastics Division of Messrs. Long & Hambly Ltd., of High Wycombe, Precision Rubber and Plastics Moulders.

Mr. Sharp has resigned from his position of Technical Manager of the Halex Division of British Xylonite Co., Ltd., where he has been for the past 10 years.

PLASTICS **BY POST**

If at any time you find difficulty in obtaining a regular copy of this journal from a newsagent or bookstall, it is as well to remember that it can be posted direct to any address in the world for the inclusive price of 36s. ($5.50) a year. Subscription orders can be handed to most newsagents or bookstalls or they can be sent to the Publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1, England.

New Appointments.—The following appointments are announced by Howards of Ilford Ltd.:—Mr. H. P. P. Hodgkins as commercial director, Mr. R. C. Patrick as assistant commercial manager, Mr. E. J. Fleetwood as home sales manager—fine chemicals, Mr. R. F. York as sales development manager, and Mr. J. W. Bertenshaw as export manager.

Meetings

March

15th.—"Printed Circuits and Automation in the Electronics Industry," by Dr. P. Eisler. The Midlands Section of The Plastics Institute, The James Watt Memorial Institute, Birmingham. 6.30 p.m.

18th.—"Recent Developments in the Use of Rigid Low Density Materials in Plastics Structures," by D. S. Mahon. The London and District Section of The Plastics Institute, The Lecture Hall of the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1. 6.30 p.m.

19th.—"Extruders and Extruding," by A. Crowther and R. Robinson. The Merseyside Section, The Institution of the Rubber Industry, The Committee Room, Liverpool Corporation Passenger Transport Office, 24 Hatton Garden, Liverpool. 7.15 p.m.

20th.—"Isocyanates and their Application," The North-Eastern Section of The Plastics Institute, Second Dining Room of the Eldon Grill, Grey Street, Newcastle. 7 p.m.

22nd.—The Annual Dinner Dance of the Yorkshire Section of The Plastics Institute, Powolnys Restaurant, Leeds.

26th.—"Polymers from Oxacyclobutanes," by Mr. A. C. Farthing and Mr. D. J. Sandiford. The Society of Chemical Industry, Plastics and Polymer Group, London. 6.30 p.m.

27th.—"Low Pressure Polythene," by Dr. von Klenck. The Scottish Section of The Plastics Institute, Glasgow.

29th.—"Low Pressure Polythene," by Dr. von Klenck. The North-Western Section of The Plastics Institute, The Engineers' Club, Albert Square, Manchester, 2. 6.45 p.m.

29th.—"Torque Convertors," Mobile Plant Discussion Group. The Birmingham Branch, Incorporated Plant Engineers, Imperial Hotel, Temple Street, Birmingham. 7.30 p.m.

April

2nd.—"Applications of Plastics in Industry," by Dr. C. L. Child. The London Branch of The Incorporated Plant Engineers, Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2. 6.30 p.m. for 7 p.m.

4th.—"High Pressure Glass Laminate Piping," by H. Winning. The Southern Section of The Plastics Institute, The Chemistry Department, The University, Southampton.

10th.—The Annual General Meeting of the Yorkshire Section of The Plastics Institute, St. Marks House, 186 Woodhouse Lane, Leeds.

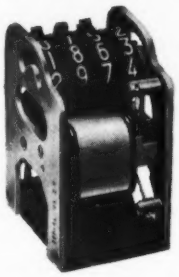
10th.—"What is Wanted from the Plastics Industry by the Motor Industry," by F. C. Watkins. The South Wales and Monmouthshire Section of The Plastics Institute, Angel Hotel, Cardiff. 7 p.m.

11th.—"Applications of Photography in Industry," by A. Horder. The Glasgow Branch of the Incorporated Plant Engineers, Scottish Building Centre, 425/427 Sauchiehall Street, Glasgow. 7.15 p.m.

Automation Equipment

Electro-Mechanical Counter.—The counter type 54/4 is a compact light-weight instrument of small size and consists of a series of moulded number wheels and pinions giving a display from 0000 to 9999. This assembly is driven from a balanced escapement mechanism of very light-weight, set in jewel bearings and energized by one or more electro magnets spaced around a common armature. Armature to pole gaps are less than .002 in. and held to close limits to ensure a highly efficient magnetic circuit.

The operational voltage is from 22–29 volts D.C. and the counter will operate on pulses of 10 milliseconds at a maximum rate of 37 per second.



The electro-mechanical counter manufactured by Counting Instruments Ltd.

Due to the construction of the mechanical assembly, the counter will not fail under severe mechanical shock and has been subjected to 7 G in two directions and maintained an accurate count.

The type 52/4 is similar to 54/4 except that it is provided with mechanical reset. This added feature, however, limits the operational speed at present to 16 counts per second.

Counting Instruments Ltd., 5 Elstree Way, Boreham Wood, Hertfordshire.

New Sequence Timer.—The illustration shows the new "Rodene" self-resetting type 2600 multi-circuit timer or sequence-controller.

The drive is provided by the self-clutching, inherently forward-running "Rodene" synchronous motor, and each circuit has a 5 amp. snap-action switch operated by an easily pre-set steel cam.

There are two standard models. One can run for up to 15 seconds and control up to four circuits; the other runs for up to one minute and controls up to eight circuits. Other gearings can be supplied.

The operation is such that when the shaft has turned through 300° it is stopped and held, but interruption of the motor supply at any time results in a spring driving the shaft back to the start position.

Alternative models can either run continually without resetting, or turn through 360° and then stop until a switch is changed over when it will make a further revolution. These units can have speeds down to one revolution per week.

D. Robinson & Co., 58 Oaks Avenue, Worcester Park, Surrey.

The new Shaw moisture monitor designed for continuous indication of moisture content.

Moisture Monitor.—This is a new instrument designed to provide a continuous indication of the moisture content of granular, powdered or fibrous materials. Moisture content of from 0 to 100% can be measured and read off the dial or recorded on a chart. The monitor needs no standardizing or correcting and works entirely on its own.

Shaw Moisture Meters, 31 Market St., Bradford, Yorkshire.

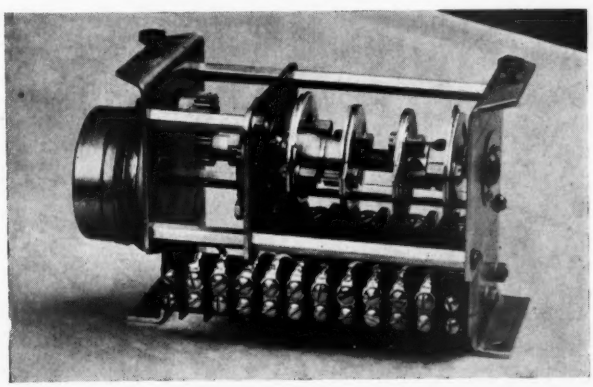
Flow Controller.—The new Flostat method of flow control combines a measuring element (flowmeter) and a controlling element (valve), both operated by the pressure energy of the fluid. It is a self-acting flow controller and no electric or compressed air supply is required for its operation.

It resembles a valve and fits directly in the pipeline. In its simplest form the Flostat is non-adjustable, being factory set for control of a certain fluid at a desired flow rate. In operation it delivers fluid within 1% of the set rate irrespective of variations of fluid pressure either upstream or downstream from the installation. For volume control the Flostat needs only to be used with a timing device and shut-off valve.

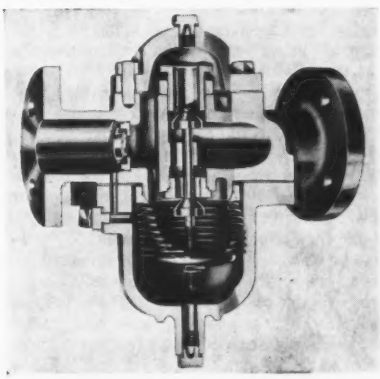
The orifice plate gives rise to a change in fluid pressure distribution, such that the high pressure zone communicates with the sealed bellows housing, whilst the low pressure zone is contiguous with the inside of the bellows. Fluid flow gives rise to a force on the bellows tending to close the double-beat valve, the stem of which is rigidly connected to the free end of the bellows, and equilibrium is established when the fluid pressure force balances the spring force of the bellows. The desired value of flow is set by adjustment of the distance of the valve heads from their seats when the bellows is in a relaxed position. For a wide range of such settings the flow rate passed by the Flostat remains constant for large pressure changes either at inlet or outlet. The double-beat valve is pressure balanced so that high sensitivity and response speed are achieved. Recovery time is often 0.5 second and rarely exceeds 3 seconds. Accuracy of flow control of $\pm$ 1% for 100 p.s.i. change in fluid supply or delivery pressure is achieved.

Adjustment of flow setting in situ can be effected by means of a simple external attachment. A flow scale can also be provided.

G. A. Platon Ltd., 323a Whitehorse Road, Croydon, Surrey.



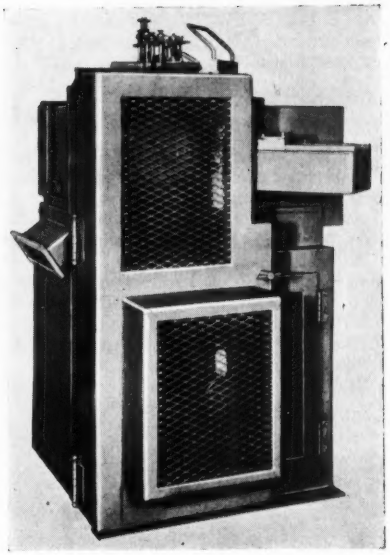
(Left) The Rodene 2600 self-resetting multi-circuit timer.



(Right) A section of the Flostat volume controller.

The Cumberland Dicing Machine

The Cumberland stair-step method of dicing sheet stock has proved for many years to be popular in the U.S.A. This machine is now being made in this country by the Burtonwood Engineering Co., Ltd., of Warrington, Lancs., and has already received acclaim for its efficiency. We have pleasure in giving here details of this machine which we are sure will be of interest to our readers.



(Right) The 7-in. Cumberland stair-step dicing machine. The feed table can be seen on the right and delivery chute on the left.

IN recent years it has been found that by using a granular material of uniform size for injection moulding and extrusion, better and more consistant results have been obtained. This has been especially true in cases where conditions have been exceptionally critical. It is not, however, our purpose to discuss this here, but we would draw the reader's attention to the Burtonwood-Cumberland Stair-step Dicing Machine, which is described in the following paragraphs.

The original stair-step dicing machine was designed and made in America by the Cumberland Engineering Company Inc., where it enjoyed considerable success. It is now being made in Great Britain under licence by Burtonwood Engineering Co., Ltd., of Warrington, Lancs., from whom we are indebted for the information given here.

The Cumberland dicer is available in two sizes accommodating sheet stock of up to 7 in. and 14 in. respectively, although its design is such that the same principles can be employed in machines for handling greater widths should this be required. A full range of plastics materials can be handled by this machine and cubes or rectangular pellets in various sizes from $\frac{1}{16}$ in. to $\frac{1}{2}$ in. produced.

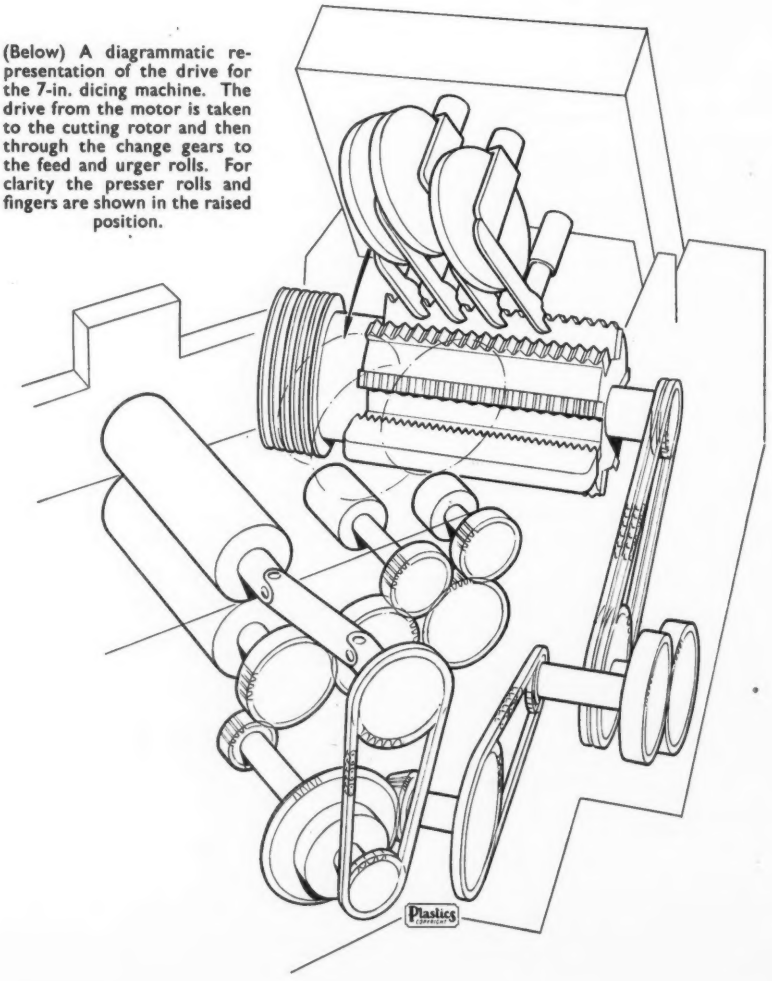
The 7-in. Stair-step Dicing Machine

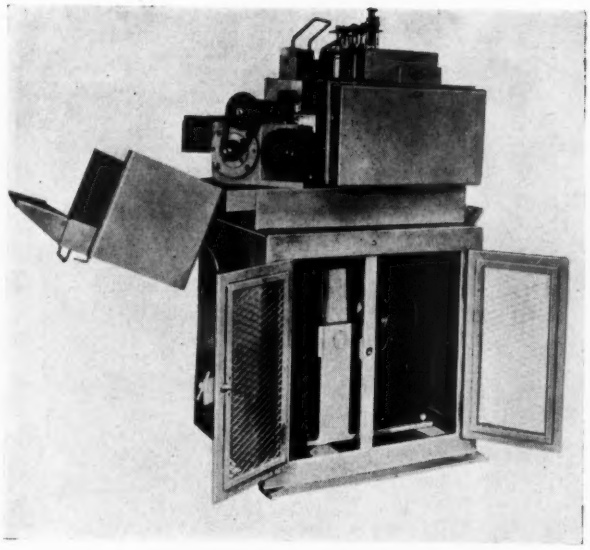
The drive for the dicer is supplied by vee belts direct to the rotor from an electric motor situated in the base of the machine. Tension on the belts is adjusted by operating the hand-wheel which pivots the motor mounting. Different speeds can be obtained by changing the sheave on the motor spindle, but where a variable speed drive is required as, for example, when the dicer is synchronized with other equipment, an automatic variable speed cone pulley can be fitted.

The rotor is supported on single and duplex bearings at each end of the shaft mounted on the main frame. At the opposite end to the drive pulley is the rotor sprocket which transmits the drive by chain through a set of change gears to the bevel gear drive assembly. Here a 19-tooth pinion meshes with a 44-tooth gear mounted on the bevel gear shaft. This shaft drives directly through a pinion the lower feed roll and by sprocket and chain and a universal joint the upper feed roll.

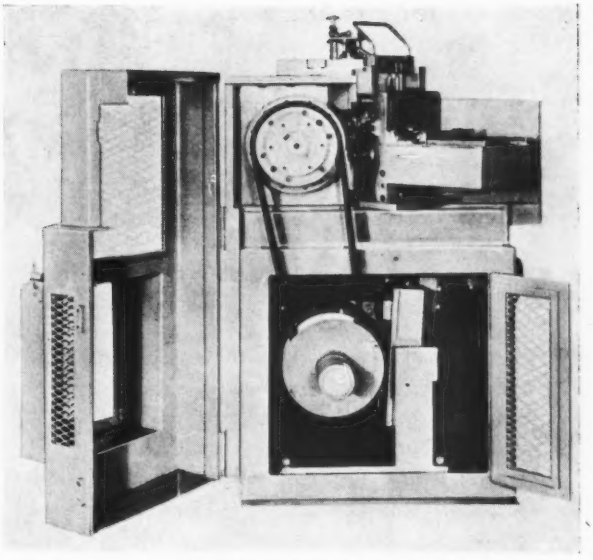
Also driven from the bevel gear shaft and feed rolls are the serrated urger rolls situated close to the cutting knives. These rolls are geared to turn at a slightly faster rate than the feed rolls and are used to control the sheet just prior to the dicing.

(Below) A diagrammatic representation of the drive for the 7-in. dicing machine. The drive from the motor is taken to the cutting rotor and then through the change gears to the feed and urger rolls. For clarity the presser rolls and fingers are shown in the raised position.





The 7-in. dicer showing the bevel gear drive.



The opposite side of the machine showing the main drive.

Feed Roll Assembly

The two feed rolls are serrated and driven directly from the rotor as described in a previous paragraph, thus ensuring an accurate stock feed even though the rotor speed may vary. Both rolls are supported on ball bearings, the upper roll has movable bearing blocks operating against compression springs thus providing the nip on the material. A safety mechanism is fitted which lifts the upper feed roll and also the pressure rolls and fingers $\frac{3}{8}$ in. clear of the sheet should it not be feeding correctly.

On the 7-in. dicer two urger rolls are fitted. These are located beneath the feed table and operate against three freely revolving spring-loaded presser rolls. In addition four presser fingers, also spring-loaded, control the sheet right up to the cutting knife. The urger roll shafts run on two sets of ball bearings and are adequately supported.

The complete presser roll and presser finger mounting can be speedily released by undoing and dropping the two swing, hold-down bolts on top of the rotor housing and uncoupling the lifting link connecting the mounting to the safety mechanism. The whole assembly can then be lifted clear and pivoted away giving clear access to the rotor, knives, and feed table.

To accommodate different sheet thicknesses the spring tension on the feed rolls and the clearance of the presser rolls and fingers can be simply adjusted. It is also necessary to adjust the position of the fly-back strip so that there is sufficient clearance without allowing the cut cubes to escape.

Dicing Knives

All the dicing machine knives are manufactured from high carbon tool steel, hardened to 60 on the Rockwell C scale. The rotor is fitted with eight knives and there is also the bed knife. It is not necessary for all the rotor knives to be fitted except when maximum input speed is used. If the input speed is halved, the rotor speed can be maintained by removal of four of the rotor knives.

The bed knife has twice as many teeth as any one of the rotor knives and when setting, alternate knives repeat the same cut.

Setting of the knives is done on the rotor, the bed knife being located on the main frame. Adjustment of the rotor knives is by set screws at the back and ends of the knives.

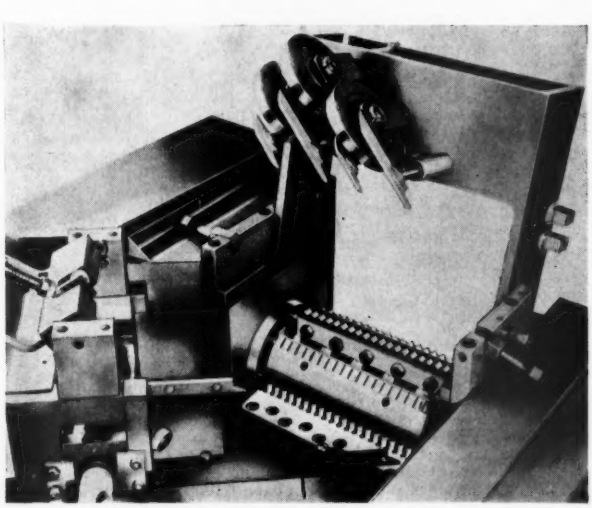
Cut Variation.

To vary the length of cut being made, a simple and easily accessible change gear combination is situated between the rotor, which is directly driven from the motor, and the bevel gear and feed roll assembly. By altering the ratio of the change gears and reducing the number of knives on the rotor a considerable variety of lengths between the maximum and minimum can be produced. A few examples of this are given in the accompanying table.

The 14-in. Dicer.

This larger machine works on the same principles as the 7-in. dicer, allowance being made for the extended width of the sheet it will accommodate. Four urger rolls are used to control the sheet instead of the two used in the 7-in. machine and additional four presser rolls and fingers are also fitted.

We wish to acknowledge the assistance received in the preparation of this article from the directors and staff of Burtonwood Engineering Co., Ltd.



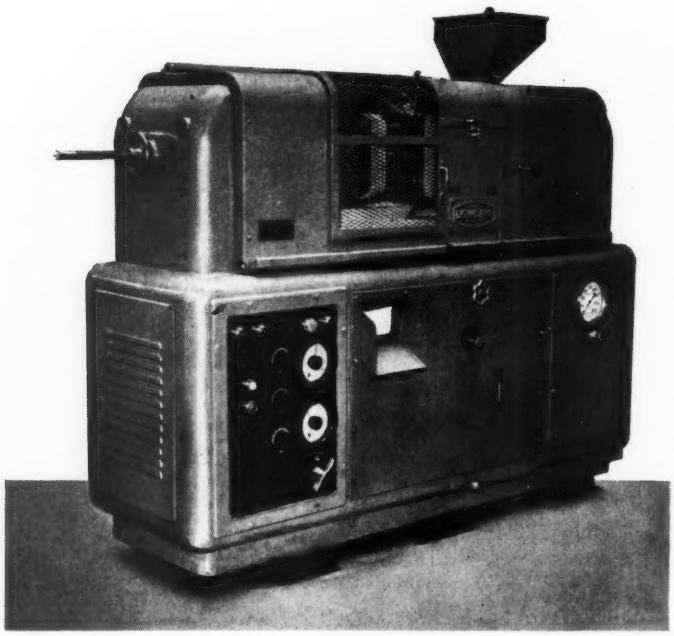
The knife of the 7-in. dicer with the presser roll assembly raised.

A SELECTION OF CHANGE GEAR COMBINATIONS WITH RESULTANT CUT-OFF LENGTHS AND FEED RATES

Change gear Combination			Length of cut in inches		
Driver	Driven	Feet per minute per 1,000 r.p.m.	2 knives	4 knives	8 knives
17	62	10·5	·126	·063	·032
20	59	13·0	·156	·078	·039
25	54	17·7	·212	·106	·053
30	49	23·3	·280	·140	·070
35	44	30·5	·366	·183	·092
40	39	39·3	·472	·236	·118
45	34	50·7	·608	·304	·152
50	29	66·2	·794	·397	·199
55	24	87·8	1·054	·529	·264
60	19	121·0	1·452	·726	·363
62	17	139·8	1·678	·839	·420

Machines for the Industry

The Dowding Fast-Cycling Series II Machine



This automatic injection moulding machine has been designed for the production of large quantities of small mouldings at a fast and economical production rate. The increased interest in the use of nylon for engineering components has led to some modifications to the machine to enable it to maintain its performance with this material.

WITHIN the last year or so there has been a considerable increase in the use of moulded nylon components particularly in what may be loosely termed the light engineering industry. This growing demand has presented moulders with several problems. One of these has been the customers' demand for a quality moulding with comparatively small tolerances, another the large quantities required and thirdly the question of price. Add to these the difficulty of moulding nylon itself and it can be seen that an entry into this market is one that has to be considered very seriously.

One of the keys to success in this field is the machinery employed. In a few cases existing injection moulding machines do perform satisfactorily but many machinery makers have made modifications in order to get the best results. We have pleasure in describing here one of these machines, namely the Dowding Automatic Fast-Cycling Injection Moulding Machine Series II. This machine combines economy of running costs, in that it is automatic, with quality moulding and fast cycling.

A brief description of the unmodified version appeared in the June, 1953, issue of *Plastics* but since then improvements in design have been incorporated and we give here a full report with details of the modifications for nylon moulding.

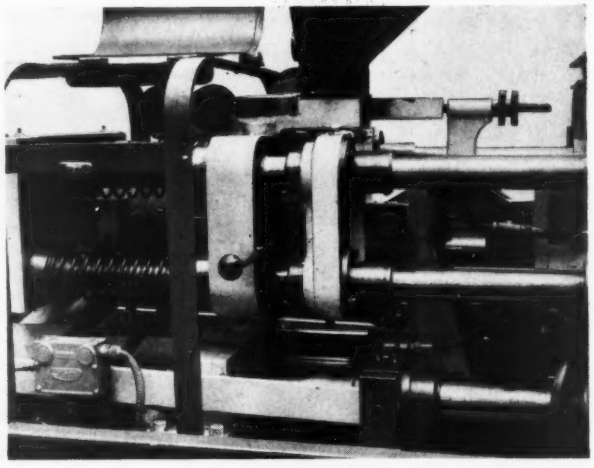
Design

Two castings support the four horizontal tie bars on which the adjustable tailstock platen (1), the injection platen (2), the charging cylinder platen (3) and the prefill platen (4) are mounted. The mould closing mechanism is by toggle (5) actuated by a link mechanism (6) from the hydraulic cylinder (7). All toggle pins and bushes are of hardened and ground steel. Ejection is by a centrally situated ejector bar (8). Hydraulic power is supplied by a British built Vickers-Detroit rotary vane pump (9) driven by a 7 h.p. electric motor. The hydraulic equipment is mounted in a tank which is accessible for servicing and contains the oil filter (10) and oil cooling unit (11). The hydraulic pressure is shown on the gauge (12).

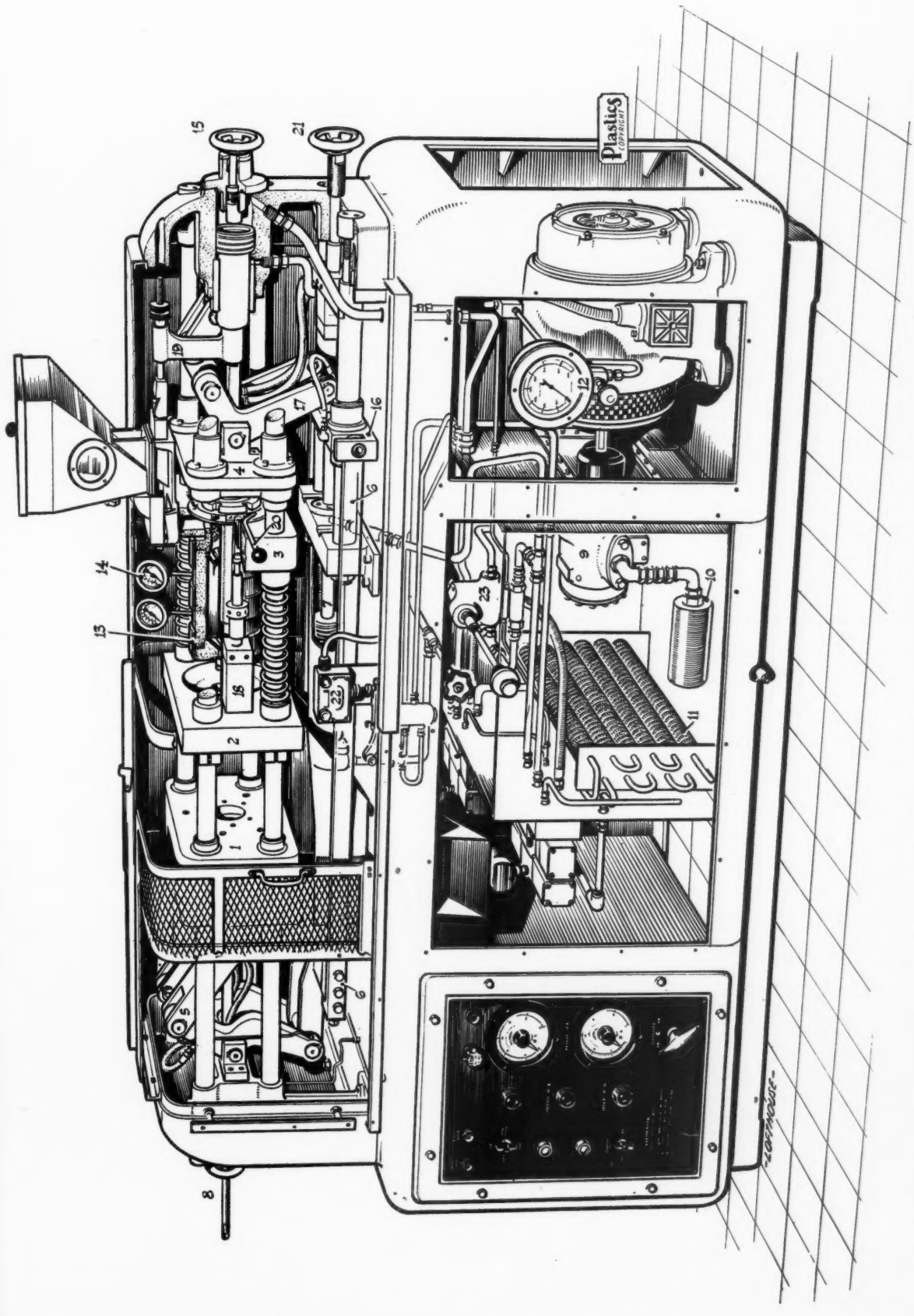
The injection cylinder is heated by three band heaters (13), two of 1,000W. and one of 750W. controlled by Sunvic energy regulators and fitted with dial thermometers (14). The cylinder itself is of interesting design being internally fluted to provide the material with the maximum contact area of the heating surface. The stroke of the injection plunger is adjusted by the hand wheel (15) and the plunger is cooled for half its length by a cooling water circuit. There is also a cooling circuit in the charging cylinder platen, and for the moulds. All of these circuits are independently controlled by disc valves. Lubrication of pins and moving parts is by the Tecalemit Bijur system and the platens are fitted with grease points.

Operation

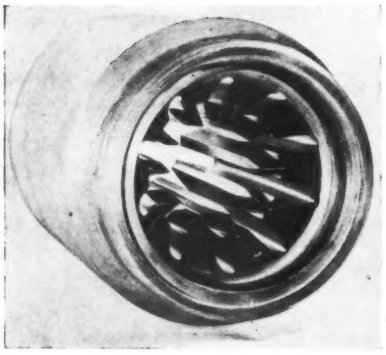
The closing force supplied by (7) moves the prefill crosshead (16) and by the link and toggle mechanism closes the tailstock platen (1). The same force working through toggle (17) moves forward the prefill platen (4) and the prefill ring feeding the granular material into the injection cylinder. At the same time, but operated from a separate hydraulic circuit, the plunger is retracted. The compressed material thus provides the force for refilling the plasticizing section of the cylinder for the next injection stroke. By this double acting compression method the injection plunger can be operated at lower pressures as it only exerts force on fully plasticized material, and no loss of power due to friction occurs. On the forward stroke of the plunger the mould cavities are filled, the piston remaining in the forward



A view of the machine showing the charging cylinder platen and prefill platens and injection platen release lever.



1.—Tailstock platen; 2.—Injection platen; 3.—Charging cylinder platen; 4.—Prefill platen; 5.—Mould close toggle; 6.—Link; 7.—Hydraulic cylinder; 8.—Ejector bar; 9.—Pump; 10.—Filter; 11.—Oil cooling unit; 12.—Hydraulic pressure gauge; 13.—Band heaters; 14.—Dial thermometers; 15.—Plunger stroke adjustment; 16.—Crosshead; 17.—Prefill toggle; 18.—Jacks; 19.—Material feed adjustment; 20.—Injection platen release lever; 21.—Buffer adjustment; 22.—Guard safety switch; 23.—Hydraulic pressure control unit.



A photograph of the injection cylinder of the machine showing the fluting.

position under pressure after completion of the filling. The force holding the plunger in this position being unable to inject more material acts, through the medium of the cylinder, on the charging cylinder platen (3). This then transmits the force through the jacks (18) to the injection platen (2) and thus provides an increased locking force. To allow this to happen the charging cylinder platen has a .060 in. lateral float. The jacks are adjusted so that the nozzle does not take any load.

The forward movement of the plunger is controlled by a cam arrangement on the mould close toggles (5) so that injection cannot take place until the toggle is locked. As an operator safety precaution, under normal working conditions the machine will not operate with the guard open. The material feed into the chamber is self-compensating and operated by the movement of the injection plunger through the arm (19). A release mechanism operated by the lever (20) is fitted so that the injection platen can be moved clear of the nozzle for cleaning or in case of blockage.

Two further points in the operating technique of this machine should be noted. Firstly the fast cycling of the machine is attained by the rapid open and close time of the mould which is about 2 seconds and by the quick injection operation due to the short stroke of the plunger which is only 2 in. maximum. The second point is that the hydraulic pump is at working pressure only during injection period which considerably decreases the wear on the pump with consequent increase in its working life.

Controls

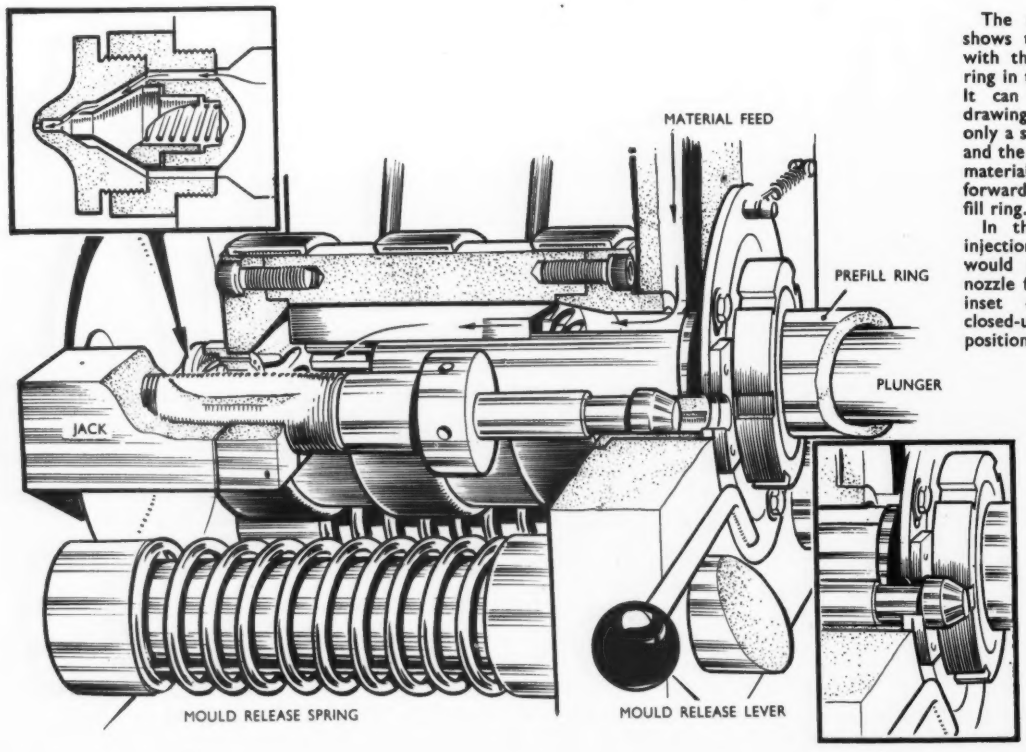
All controls are arranged on a single panel adjacent to the moulding discharge chute. On the panel are two Chamberlain and Hookham process control timers and the three Sunvic heater controls. Push-button switches for use when hand operating the machine as well as a master stop button and the hydraulic pump control button are situated at the top of the panel. A four-way switch is used for selecting hand or automatic cycling or for inching during mould setting. There is also a master isolating switch and heater switch.

Specification

The principal features of this machine are given in the table below. Another feature not mentioned is the ability of the machine to mould most thermoplastic materials, excluding p.v.c., but including, after certain modifications which will be dealt with later, nylon.

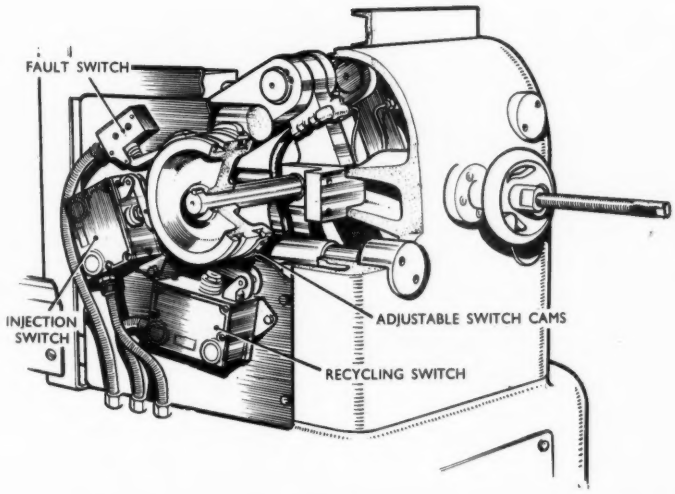
SPECIFICATION

Maximum recommended moulding capacity	23.6 c.c.
Machine cycles (maximum dry cycling)	1,200
Approximate plasticizing capacity per hour (cellulose acetate)	20 lb.
Diameter of injection plunger	1⅝ in.
Area of injection plunger	2.074 sq. in.
Pressure per square inch on material at end of plunger	9,100 lb.
Total pressure on injection plunger	18,850 lb.
Maximum stroke of injection plunger (adjustable)	2 in.
Size of die platens	10 in. x 16 in.
Mould opens (adjustable)	8¾ in.
Maximum die space (between tailstock platen and front of nozzle)	6½ in.
Minimum die space	3½ in.
Maximum recommended casting area in mould	15 sq. in.
Capacity of feed hopper	15 lb.



The drawing on the left shows the injection cylinder with the plunger and prefill ring in the retracted position. It can be seen from this drawing that the plunger has only a small distance to travel and the initial pressure on the material is supplied by the forward movement of the prefill ring.

In this drawing also the injection platen and mould would be well clear of the nozzle for cleaning, etc. The inset drawing shows the closed-up and normal working position of the unit.



(Left) A cut-away drawing of the cam assembly which controls the forward movement of the plunger.

Modifications for Nylon Moulding

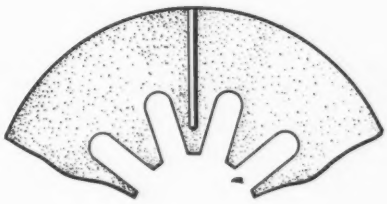
For moulding nylon certain modifications have been made to the Dowding Series II machine. To obtain optimum results the design of the hydraulic and electrical circuits has been modified and a third process timer added. The function of this timer is to initiate the withdrawal of the injection plunger immediately on completion of the injection period. The plunger does not, therefore, as in the standard machine, remain in the forward position until the commencement of the next cycle. A pressure reducing valve has also been introduced in the injection plunger forward hydraulic circuit to provide a means for adjusting the injection pressure.

One of the most important modifications is that of the injection cylinder nozzle which has been entirely re-designed. After considerable experiment and development the nozzle adopted for use is one in which a thermal seal of the nylon itself prevents exudation of the plasticized nylon in the mould open position. It is claimed that this design of nozzle, which has no moving parts, is less prone to breakdown than some of the types in which a valve is employed.

Temperature Control

Special attention has been given to the question of temperature regulation and distribution. The total wattage of the heater bands has been increased to 4 kW.: this figure excludes the additional band fitted to the nozzle and each of the heaters is individually controlled by Temcon equipment. The system for control of the temperature is that originally advocated by Mr. L. Griffiths, of I.C.I., whereby the hot junction of the control thermocouple is situated directly beneath the band heaters and the temperature indicating thermocouple is placed as close to the plastics material as possible. This, as can be seen from the drawing, is most effectively placed in the flutes of the cylinder wall in this machine. The result of this temperature controlling system is a remarkably accurate heat distribution with little or no " hunting " or fluctuation. A single dial temperature indicator on the control desk, connected through a multi-way switch, gives the readings for the different heating zones. The control desk is separate on the nylon modified machine.

A drawing showing the position of the thermocouple in the injection cylinder on the nylon modified machine.



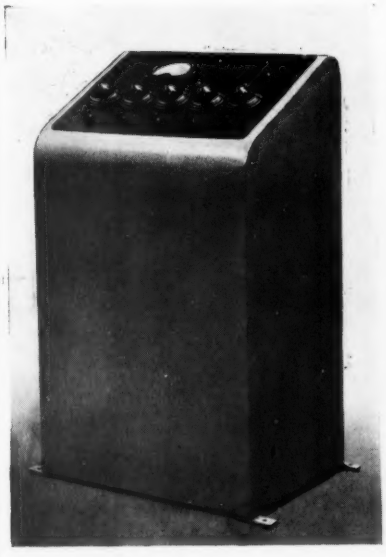
Specification for Nylon

The amendments to the specification for nylon moulding are given in the table below.

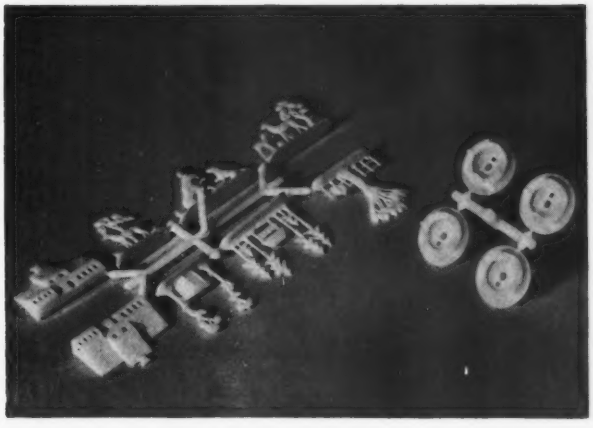
SPECIFICATION DETAILS FOR NYLON MOULDING

Maximum recommended moulding capacity	22 grammes
Minimum recommended moulding capacity	7 grammes
Approximate plasticizing capacity per hour	10 lb.
Maximum die space between tail stock platen and front of nozzle...	6¼ in.
Maximum recommended casting area in mould	11 sq. in.

We wish to acknowledge the considerable help and co-operation we have received from the staff of Dowding and Doll Ltd. in the preparation of this report.



(Left) The control panel for the injection moulding of nylon.



(Right) Two shots being produced on the Dowding machine. The nylon gears are moulded at 300 per hour, the polystyrene farm scene at 375 per hour.

TALKING SHOP . . .

"Speaking from the Chair." Under this heading, *The Spectator* (issue dated February 1) recently published an article by Mr. Charles Glassey, managing director of British Industrial Plastics Ltd. Writing of the export possibilities of the plastics industry, he pointed out that in 1938 we exported materials to the value of £377,000, in contrast to £12,842,000 in the first half of 1956. Noting that selling abroad is becoming more competitive, and that Britain has few exportable plastics that cannot be obtained elsewhere, he said that our industry's present large share of the export market could only be maintained on quality, price, after-service, and continuity of supply. He urged the formation of technical "flying squads," based on factories in this country, to deal with customer problems on an on-the-spot basis.

In advocating this policy, Mr. Glassey speaks with authority; no company than his own is more active in moving its personnel around the world, servicing the requirements of customers in countries as far apart as Sweden and the Argentine.

* * *

Pottery v. Plastics. According to a recent newspaper report, Mr. S. H. Jerrett, director of the British Pottery Manufacturers Association, is alleged to have said "But plastics will not put the pottery industry out . . . plastic articles do not reduce breakage and do not last longer than pottery." This was in answer to a question "what are the possibilities of plastics replacing pottery, and if they do, will it be a good thing?"

It is expected of any representative of a trade society that he will defend to his last drop of blood the interests of that trade but it is a pity that a member of the plastics industry was not at hand to put the other point of view. If plastic cups and saucers do not reduce breakage in such places as factory canteens, railway buffets and the like, then I will eat my bearskin bowler. Only an apathetic public permits the present state of affairs to continue, where you are invited to drink tea or coffee from a cracked or chipped "pottery" cup. In countries where public health is a little more enlightened, a raspberry of no mean dimensions would result from a chipped cup being handed out at a cafeteria.

Sad though it may be for the pottery interests, the rate of breakage and loss in large canteens is such that a substitute material will have to be employed. And even the housewife is going to give the plastic cup a second thought when she sees some of the beautiful designs recently exhibited at a famous London store. Contemporary in the best sense, in exquisite colours, these cups and saucers will stand comparison with the best that pottery can achieve. They are moulded in melamine, and have a lustrous depth of colour, and a silky finish.

* * *

Federation Dinner-Dance. On February 15, at the Grosvenor House, Park Lane, the British Plastics Federation held its annual Dinner Dance: over 800 sat down to dine in the Great Hall, and afterwards to dance and to watch the cabaret and the film of the Torquay Conference. Mr. Cyril Last, chairman of the Federation, gave, as usual, of his best in his speech. A word of praise for Mr. Basil Aldis who did so much to arrange this function; apart from a superlative dinner, the timing was excellent and the ladies gift well-chosen. An Ekco hot-plate, I should imagine that a good many households have been eating more elegantly during the last week or two!

* * *

London Section Junior Lecture. Mr. James Butler, director of B.I.P. Engineering Ltd., gave the second Junior Lecture of the current session to an audience of over 100 at the Borough Polytechnic on February 20. His subject was "Machinery in the Plastics Industry." In the space of just over an hour, Mr. Butler reviewed the development of plastics machinery from the 1920's, showing how, by the employment of logic, equipment had caught up with the requirements of modern industry.

As we have come to expect of him, his lecture was admirably sprinkled with "stories from life." Perhaps the most amusing was his encounter, before the war, with a gigantic compression press, covering an area of about 30 ft. square, and designed to operate automatically. It had 24 rams spaced radially around the circumference of the machine. Designed in Germany, it was brought to Birmingham and erected there, after which it was under the tender care of Mr. Butler, at that time works manager. Such were the awesome dimensions of this contraption and its ponderous motion that the moulders were accustomed to chant the old song the last line of which runs "and the merry-go-round broke down." So did the press; to such an extent that during one week he worked 96 hours. A phone beside his bed, he was accustomed to waking in the early hours to hear down the wires the doleful chorus "and the . . ."! This experience, he said, had since completely put him off that particular song.

Say what you will, push-button control and automation have certainly taken away some of the comedy of life in a factory.

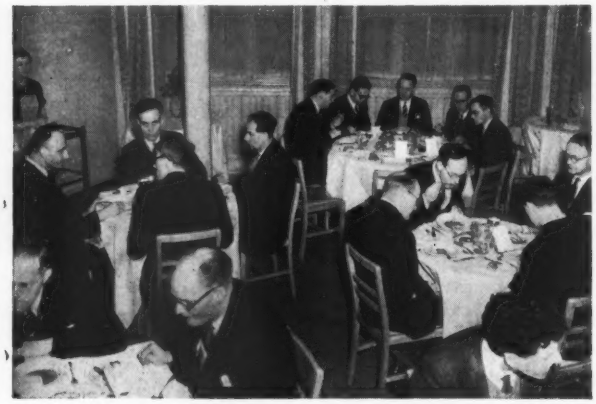
* * *

Careers Masters Hear about Plastics. A continuing problem to teaching centres is the lack of suitable young men and women to undergo full-time courses in plastics technology. As a means of rectifying the situation, the London Section of the Plastics Institute recently organized a luncheon for careers masters from London schools, at the Borough Polytechnic.

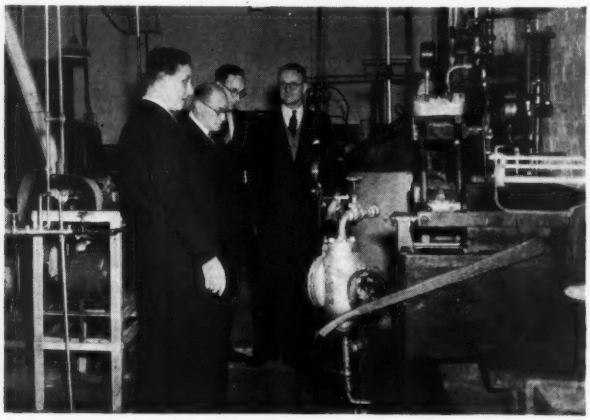
Greeted by Dr. James Garside, principal of the Polytechnic, they lunched and then toured the plastics department, seeing both the chemical laboratories and the practical workshops. They were escorted by members of the London Section Committee as guides. Mr. Phillip Morgan, chairman of the Section, then introduced Dr. C. A. Redfarn, a visiting lecturer to the polytechnic, who spoke briefly on the possibilities for young people in the plastics industry.

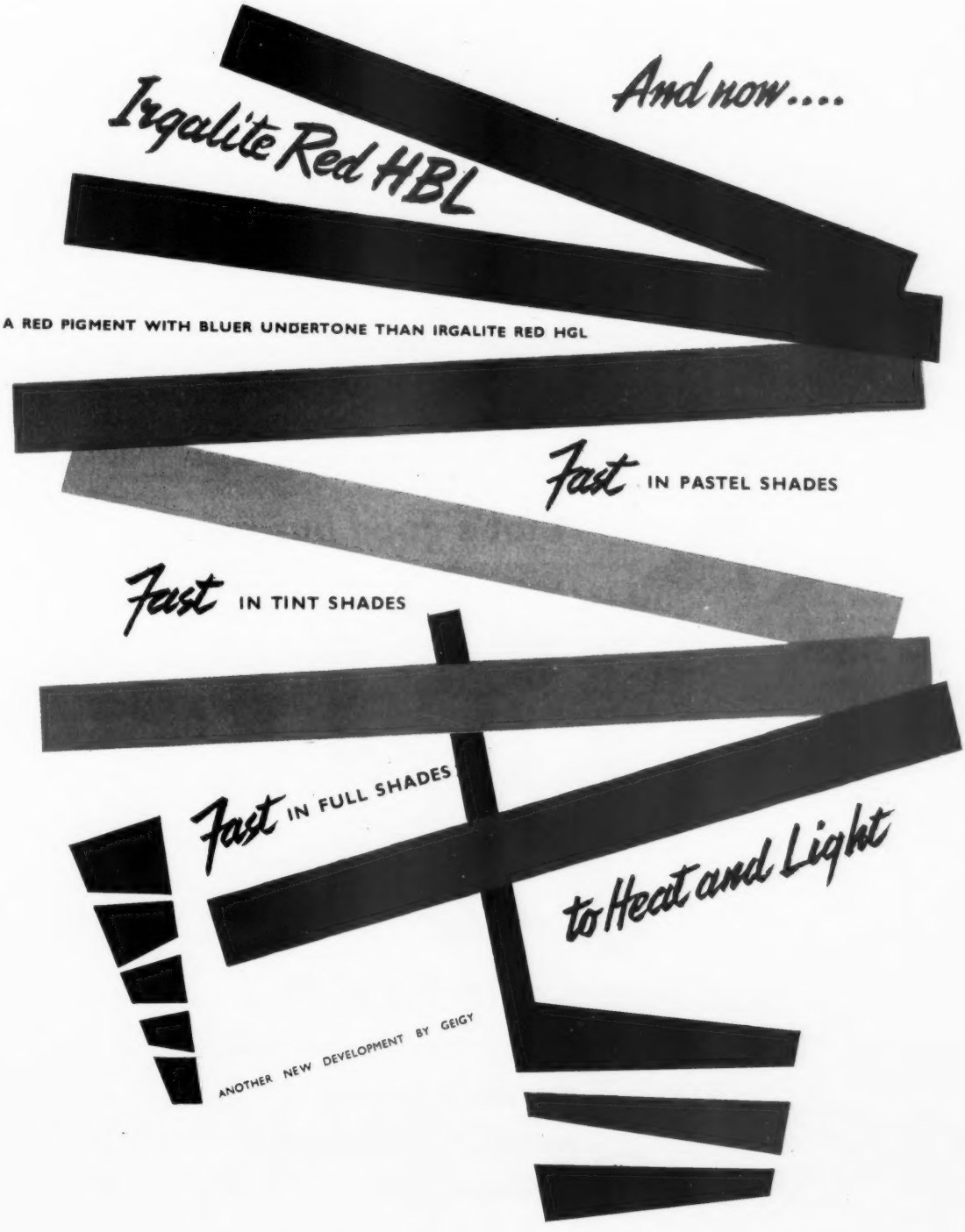
This meeting was probably unique, and certainly served to create great interest on the part of the careers masters who hitherto had known little of our industry. I hope that this is the forerunner of a nation-wide campaign to recruit the best that schools can offer.

PLASTIKON.



Luncheon for careers masters, held at the Borough Polytechnic recently, to create interest in plastics.



Mr. Denis Mahon, member of the London Section Committee, shows some masters round the Borough laboratories.

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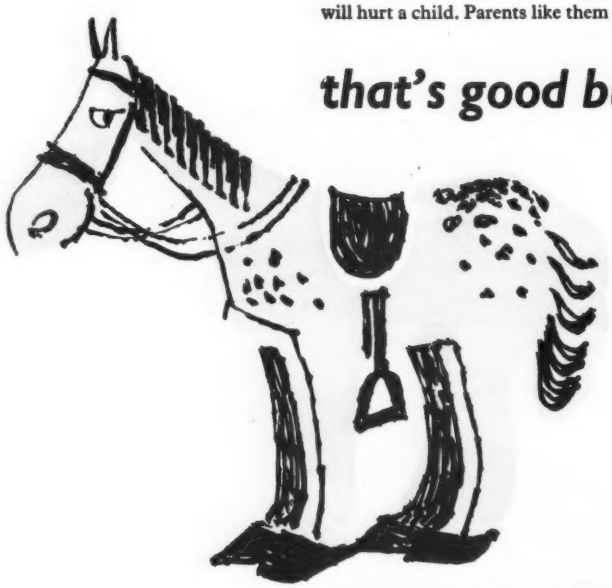

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PC(2)4

Plasticizers for Use in Food Packaging and Conveying Materials

By A. HILL,* B.Sc.(Tech.), A.R.I.C.

This paper was first presented at the 1956 Swedish Plastics Federation Convention, and is published here by agreement with the Federation

WITH increasing interest in the use of plastics films and coatings for food packaging and conveying, there is an obvious demand for information on the toxicity of polymers, plasticizers and stabilizers. It is the object of this paper to review the literature concerning the toxicity of plasticizers and to assess the value of such data for the use of plasticizers in p.v.c. and cellulose acetate compositions, not only from the point of view of statements regarding the toxicity of individual plasticizers but also from the point of view of plasticizer technology. It should be mentioned at this juncture that both polyvinyl chloride and cellulose acetate have been "considered suitable for food use" (1).

The only official government department which appears to give positive recommendations on this subject is the Division of Pharmacology, Food and Drug Administration, Department of Health, Education and Welfare, Washington, D.C., under the direction of Dr. A. J. Lehman. In the United Kingdom there has been much activity over the past two years, both in the British Plastics Federation and in a closely associated technical committee sponsored by a number of private firms, with an ultimate view of making positive recommendations on plasticizers and stabilizers. In addition, there is a much longer-term and wider project, embracing the whole chemical field, sponsored jointly by the Department of Scientific and Industrial Research and the Association of British Chemical Manufacturers. In the meantime, hopeful of the outcome of these deliberations, we must rely on the invaluable work of the Food and Drug Administration and a few private publications in the medical and technical press.

Insofar as the United States are concerned, it has been stated (2) that: "A food is deemed to be adulterated under the Federal Food, Drug, and Cosmetic Act, if its container is composed in whole or part of any poisonous or deleterious substance which may render the contents injurious to health. Thus, as new ingredients are proposed for use in the manufacture of plastic food wraps, it becomes necessary to establish the safety of each component of the finished film. This programme involves comprehensive chemical and pharmacological investigations, and for this reason the evaluation process of a new constituent is not a rapid one."

This statement is universally applicable, but in some countries the adulteration laws may go even further, in that gross contamination of a foodstuff with another material, however innocuous, may be deemed to contravene the law. The remarks regarding length of the evaluation process will serve to indicate why we cannot always find data on a particular plasticizer which may be of special and immediate interest. The complete process of evaluation is not only lengthy but demands great skill and experience, involves many animals with continual personal supervision and hence is costly.

* The Geigy Co., Ltd.

The basic considerations in determining the safety of chemicals for use in food-packaging materials have been conveniently and lucidly described by A. J. Lehman and W. I. Patterson (13), but for more detailed information a recent article by A. J. Lehman, *et al.*, entitled "Procedure for the Appraisal of the Toxicity of Chemicals in Foods, Drugs and Cosmetics," should be consulted. Various authors have contributed sections to the article, the titles of which, together with occasional brief explanations, are as follows:—Chemistry: Purity, solubility, stability, changes in structure during use, etc. Acute Toxicity: Short term tests involving single doses to give initial information on toxicity. Pharmacodynamics: Mechanism of pharmacological action on various sites of the body. Biochemistry: Reasons for the toxic properties of a substance. Range-Finding and Subacute Toxicity: Extension of acute toxicity tests. Continued dosages are employed for periods of two to three months (mice and rats) and one to two years (dogs). Chronic Oral Toxicity: Long term feeding over lifetime of animal (1½–3 years albino rats). Carcinogenicity. Dermal Toxicity. Pathology. Statistics.

The review of the literature on the toxicity of plasticizers is set out in Table I and in studying this table it is essential that the following notes be borne in mind:—

(1) Alternative names are given for certain plasticizers. In these cases, the particular name used in the original literature is indicated by the reference number alongside. Trade names are used *only* where these have been quoted in the literature.

(2) Where conclusions on toxicity and recommendations regarding use in connection with foodstuffs have been made, only these are mentioned in the table.

(3) Where only the results of toxicity trials in terms of animal dosage levels are summarised in the table, no conclusions have been given in the literature regarding toxicity to humans or use in contact with foodstuffs.

(4) Alongside the literature reference number, the author has added an investigational classification letter, A or B, the significance of which is as follows:—

A. This includes the recommendations of the Food and Drug Administration, Washington, and also the work of others, where investigations appear to be sufficiently long term in nature to warrant final conclusions.

B. In this classification, the work does not involve sufficient investigation to warrant final conclusions. The work involves only the examination of acute toxicity and terms "non-toxic," "moderately toxic" and "highly toxic," which are quoted in Table I, have been defined in the original article in terms of various levels of single dosages, to kill 50% of the laboratory animals, i.e. in terms of L.D.50 values. The results of such tests can only be used to assist in planning longer term investigations and not as a final indication of the suitability of plasticizers for use in foodstuff applications.

The plasticizers in Table I, which come within the investigational classification A, are listed in Table II. These are classified into four categories, which are described in the following notes on Table II.

(1) Only plasticizers with the investigational classification A in Table I are included.

(2) One name only is used for a single plasticizer. For alternative names see Table I.

(3) The classification into four categories of toxicity has the following significance:—

I. Plasticizers which have been deemed acceptable for use in foodstuff applications, or which are of a low order of toxicity.

II. Plasticizers which have been deemed acceptable for use in foodstuff applications but with limitations.

III. Plasticizers concerning which there appears to be some doubt as to the advisability of their use.

IV. Plasticizers which are too toxic for use.

TABLE II

List of Plasticizers subjected to long-term investigation (Classification A—Table I)

Plasticizer	Toxicity Classification	Reference
Glyceryl triacetate	I	(15)
Di-iso-butyl adipate	I	(1) (15)
Acetyl tributyl citrate	I	(1) (9) (15)
Acetyl triethyl citrate	I	(15)
Monoisopropyl citrate	I	(15)
Stearyl citrate	I	(15)
Triethyl citrate	I	(15)
3-(2-xenoxyl)-1, 2 epoxy propane	I	(15)
Paraplex G.60	I	(15)
Paraplex G.62	I	(15)
Glyceryl mono-oleate	I	(1) (15)
Methoxyethyl oleate	IV	(4)
Tritolyl phosphate	IV	(2) (15)
2-ethylhexyl diphenyl phosphate	I	(1) (11) (15)
Dibutyl phthalate	III	(3) (4)
Dicapryl phthalate	I	(3)
Diethyl phthalate	I	(15)
Di-2-ethylhexyl phthalate	II	(1) (6) (7) (8) (15)
Di-iso-octyl phthalate	II	(2) refer back to (1) (15)
Ethyl phthalyl ethyl glycolate	I	(1) (15)
Butyl phthalyl butyl glycolate	I	(1) (10) (15)
p-Tertiary butyl phenyl salicylate	I	(1)
Dibutyl sebacate	I	(2) (4) (15)
Butyl stearate	I	(2) (4) (15)

This paper is not concerned with the special subject of the toxicity of the aryl phosphates. Tritolyl phosphate (tricresyl phosphate) is included here only because a published statement was made by the Food and Drug Administration (2). Dibutyl phthalate, concerning which doubts regarding its use have been

TABLE I
REVIEW OF LITERATURE

Plasticizer	Statement on Toxicity	References*
ACETATES		
Glyceryl triacetate (15) Triacetin	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
ADIPATES		
Di-iso-butyl adipate	Harmless in amounts used in commercial films	Lehman (U.S.F.D.A.) (1) (15) A.
Di-2-ethylhexyl adipate (5) Dioctyl adipate D.O.A.	Non-Toxic	Mallette and Von Haam (5) B.
AZELATES		
Di-2-butoxyethyl azelate Di-butylcellosolve azelate (5) Di-butylglycol azelate	Non-Toxic	Mallette and Von Haam (5) B.
Dicyclohexyl azelate Cyclohexyl azelate (5)	Non-Toxic	Mallette and Von Haam (5) B.
Di-2-ethylhexyl azelate 2-ethylhexyl azelate (5) Dioctyl azelate	Non-Toxic	Mallette and Von Haam (5) B.
Methyl isobutyl carbinol azelate (5) (not clear if monomethyl mono-isobutylcarbinol or di-methylisobutylcarbinol)	Non-Toxic	Mallette and Von Haam (5) B.
Diamyl azelate (from mixed isomeric alcohols—Sharples Chemicals) Pentasol azelate (5)	Non-Toxic	Mallette and Von Haam (5) B.
CAPRATES		
Diethyleneglycol dicaprate	Non-Toxic	Mallette and Von Haam (5) B.
CAPRYLATES		
Triethyleneglycol dicaprylate Plasticizer SC (Drew) (5)	Non-Toxic	Mallette and Von Haam (5) B.
CITRATES		
Acetyl tributyl citrate	(a) Harmless in amounts used in commercial films. (b) No toxic effects.	Lehman (U.S.F.D.A.) (1) (15) A. Seeler *et al.* (9) A.
Acetyl triethyl citrate	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
Monoisopropyl citrate	Acceptable for use in commercial films	Lehman(U.S.F.D.A.) (15) A.
Stearyl citrate	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
Triethyl citrate	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
EPOXY COMPOUNDS		
3-(2-xenoxyl)-1, 2 epoxy propane	Harmless in amounts used in commercial films	Lehman (U.S.F.D.A.) (15) A.
Paraplex G.60 (15) (an epoxidised natural glyceride of unsaturated fatty acids)	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
Paraplex G.62 (15) (an epoxidised natural glyceride of unsaturated fatty acids)	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
GLYCEROL DERIVATIVES (See Acetates, Epoxy Compounds and Oleates)		
OLEATES		
Glyceryl mono-oleate	Harmless in amounts used in commercial films	Lehman (U.S.F.D.A.) (1) (15) A.
Methoxyethyl oleate (4) Methylcellosolve oleate Methylglycol oleate	Did not feel it should be incorporated into films for food wrapping	Smith (4) A.
PELARGONATES		
Diethyleneglycol dipelargonate Plastolein X-55 (Emery) (5)	Non-Toxic	Mallette and Von Haam (5) B.
PHOSPHATES		
Tricresyl phosphate (1) Tritolyl phosphate T.C.P. T.T.P.	Too toxic for use in direct contact with foods. (N.B.—Preferred name in U.K. is *tritolyl phosphate* since this cannot be abbreviated to T.C.P., which is the name of a proprietary gargle.)	Lehman (U.S.F.D.A.) (1) (15) A.
2-ethylhexyl diphenyl phosphate (1) (11) Mono-octyl diphenyl phosphate Santicizer 141 (5) (11)	(a) Harmless in amounts used in commercial films. (b) Moderately toxic to laboratory animals. (c) No definite conclusions but results indicate low level of toxicity in keeping with statement under (a) above.	Lehman (U.S.F.D.A.) (1) (15) A. Mallette and Von Haam (5) B. Treon, Deutra and Cleveland (11) A.
Monotolyl diphenyl phosphate Santicizer 140 (5)	Moderately toxic to laboratory animals	Mallette and Von Haam (5) B.
PHTHALATES		
Butylbenzyl phthalate (5) Monobutyl monobenzyl phthalate	Moderately toxic to laboratory animals	Mallette and Von Haam (5) B.
Butylcyclohexyl phthalate Monobutyl monocyclohexyl phthalate Plasticizer 50B (Barrett) (5) Elastex 50-B	Non-Toxic.	Mallette and Von Haam (5) B.
Dibutyl phthalate (3) (4) Di-n-butyl phthalate	(a) Acutely toxic taken by mouth. No chronic poisoning over long periods in amounts up to 2.5 g./Kg. of diet. (b) Did not feel it safe to use in films for food wrapping.	Seifter (3) A. Smith (4) A.
Dicapryl phthalate	(a) Non-Toxic. (b) Low acute toxicity taken by mouth. No chronic poisoning over long periods in amounts up to 2.5 g./Kg. of diet.	Mallette and Von Haam (5) B. Seifter (3) A.
Diethyl phthalate	Acceptable for use in commercial films	Lehman (U.S.F.D.A.) (15) A.
Di-2-ethylhexyl phthalate (1) (6) (7) (8) 2-ethylhexyl phthalate Dioctyl phthalate (5) D.O.P.	(a) Suitable in films for wrapping foods with a high water content, e.g. fresh fruit and vegetables. No objections to use in the manufacture of beverage, milk and intravenous tubing. Not suitable for bacon, lard, oleomargarine, butter or other food with high fat content since readily oil soluble. (b) Moderately toxic to laboratory animals. (c) Low order of toxicity. (d) Low toxicity. Health hazards involved in use as a plasticizer are slight. Such injurious action as does occur appears to be due to the alkyl part of molecule. (e) Two year " no effect " level when feeding rats, 0.06–0.20 g./Kg/day. One year " no effect " level for dogs and guinea pigs approx. 0.06 g./Kg/day.	Lehman (U.S.F.D.A.) (1) (15) A. Mallette and Von Haam (5) B. Hodge (6) A. Shaffer, Carpenter and Smyth (7) A. Carpenter, Weil and Smyth (8) A.
Di-iso-octyl phthalate (2) D.I.O.P.	Toxicity and leachability parallel that of already accepted (with limitations) di-2- ethylhexyl phthalate	Lehman (U.S.F.D.A.) (2) (15) A.
PHTHALYL GLYCOLATES		
Ethyl phthalyl ethyl glycolate (1)	Harmless in amounts used in commercial films	Lehman (U.S.F.D.A.) (1) (15) A.
Butyl phthalyl butyl glycolate (1) (10)	(a) Harmless in amounts used in commercial films. (b) No toxic effects.	Lehman (U.S.F.D.A.) (1) (15) A. Seeler *et al.* (10) A.
POLYESTERS		
Paraplex G.25 (Rohm and Haas) (5) Poly propylene sebacate 1, 2 propyleneglycol/sebacic acid polyester	Non-Toxic	Mallette and Von Haam (5) B.
POLYETHYLENEGLYCOL DERIVATIVES (See Caprates, Caprylates and Pelargonates)		
RICINOLEATES		
Methyl acetyl ricinoleate (5)	Non-Toxic	Mallette and Von Haam (5) B.
SALICYLATES		
p-Tertiary-butyl phenyl salicylate	Harmless in amounts used in commercial films	Lehman (U.S.F.D.A.) (1) (15) A.
SEBACATES		
Dibutyl sebacate (2) (4) (5) Di-n-butyl sebacate	(a) Safe as an ingredient of plastic food wraps. (b) Little, if any, potential hazard for humans when used in films for food wrapping. (c) Non-Toxic.	Lehman (U.S.F.D.A.) (2) (15) A. Smith (4) A. Mallette and Von Haam (5) B.
Di-2-ethylhexyl sebacate Dioctyl sebacate (5) D.O.S.	Non-Toxic	Mallette and Von Haam (5) B.
STEARATES		
Butyl stearate	(a) Safe as an ingredient of plastic food wraps. (b) Little, if any, potential hazard for humans when used in films for food wrapping.	Lehman (U.S.F.D.A.) (2) (15) A. Smith (4) A.

* Including investigational classification (A or B)

expressed (4), may have already been used for some foodstuff applications, but it has not yet been cleared by the Food and Drug Administration in their recent publication in October, 1945 (15), and must, therefore, be classified under III.

Di-2-ethylhexyl phthalate (DOP) and di-iso-octyl phthalate (DIOP) have been recommended for use only with foods of high water content (1) (15). It is interesting, in connection with DOP, to note the remarks of Schaffer, Carpenter and Smyth (7) that such injurious action as does occur, appears to be due to the alkyl part of the molecule.

The Application of Acceptable Plasticizers in Plastics Compositions

Only plasticizers with the toxicity classification I and II in Table II will be considered. The usefulness of certain of the plasticizers listed in Table II under the Toxicity Classification I is not very clear. These are: Monoisopropyl citrate, Stearyl citrate, 3-(2-xenoxyl)1-2 epoxy propene, Glyceryl mono-oleate, p-tertiary-butyl phenyl silicylate, Butyl stearate.

There are, of course, other polymer systems requiring the use of plasticizers which are not being considered here and which are acceptable for food packing, e.g. rubber hydrochloride (2) and polyvinyl alcohol (2). Butyl stearate would be suitable as a lubricant in p.v.c. compositions.

P.V.C. Plastics

In considering the plasticization of polyvinyl chloride, further members of Table II can be discarded. Di-isobutyl adipate is too volatile for practical purposes in p.v.c. systems. Of the citrates only acetyl tributyl citrate need be considered, since acetyl triethyl citrate is more volatile and is water soluble to the extent of about 0.7 g/100 ml at 25° C., whilst triethyl citrate is even more volatile and water soluble.

Of the epoxy compounds only Paraplex G62 need be considered, since this is a more compatible version of Paraplex G60. The latter is recommended only for use in small percentages as a stabilizer, which will at the same time contribute its quota of plasticizing action without danger of sweating. Diethyl phthalate is too volatile for consideration in p.v.c. work. Of the phthalyl glycolates only the least volatile, namely, butyl phthalyl butyl glycolate need be considered.

The p.v.c. plasticizers selected for final appraisal are listed in Table III. In this table some of the more important properties are considered. Ageing refers to the volatility loss from p.v.c. compositions; the other titles are self-explanatory. The level of performance with regard to these properties has been arbitrarily and simply classified into four categories, namely, "excellent," "good," "moderate" and "poor."

Di-2-ethylhexyl sebacate and polypropylene sebacate are not plasticizers which have been approved for use in foodstuffs, but have been added to the bottom of the list to assist in comparing performance properties. They both have excellent ageing properties, but with respect to resistance to non-aqueous media and low temperature performance, they represent extremes of each scale, viz. the diester is poor in the former and excellent in the latter, whilst the polyester is just the reverse.

It is hoped that the author will be forgiven for presenting Table III in this descriptive manner as opposed to numerical results of tests. Before classifying each plasticizer, numerical results of tests carried out in our laboratories and those quoted in technical journals and trade literature have been consulted. To present numerical results would not give a lucid and comprehensive picture, especially when one considers the variety of methods of test. The object of Table III is to help in making an initial selection for different applications. Before making a final choice it is essential that the manufacturer tests out the composition under conditions which emulate, as closely as possible, those under which the final packaging, conveyor tubing or belting has to operate.

Resistance to petrol refers to a mixture of aromatic and aliphatic hydrocarbons and is included to indicate that, as yet, no plasticizer has been deemed safe for foodstuffs which is highly resistant to non-aqueous media.

Significance of Resistance Properties

The resistance to water, oils and fats has a dual significance. One concerns toxicity and the other the mechanical performance of the p.v.c. composition. Even if a plasticizer has a high degree of resistance to a particular medium and yet is considered highly toxic, it would never be employed, e.g. tritolyl phosphate. Other plasticizers which are harmless, yet have poor resistance to, say, oils and fats, e.g. dibutyl sebacate, would not be used in high percentages with fatty foods, since the p.v.c. packaging would deteriorate in mechanical properties due to plasticizer loss from the p.v.c. composition. Furthermore, it is possible even with a harmless plasticizer that gross contamination of the foodstuff may contravene adulteration laws.

TABLE III
(P.V.C. Compositions)

Plasticizer (*limited approval)	Ageing	Low Temp. Performance	RESISTANCE TO			
			Petrol	Olive Oil	Mineral Oil	Water
Acetyl tributyl citrate	Moderate	Good	Poor	Moderate	Moderate	Good
Paraplex G.62	Excellent	Moderate	Poor	Moderate	Good	Excellent
2-ethylhexyl diphenyl phosphate	Moderate	Good	Poor	Poor	Poor	Good
Dicapryl phthalate...	Good	Good	Poor	Poor	Poor	Excellent
Di-2-ethylhexyl phthalate* ...	Good	Good	Poor	Poor	Poor	Excellent
Di-iso-octyl phthalate*	Good	Good	Poor	Poor	Poor	Excellent
Butyl phthalyl butyl glycolate ...	Moderate	Good	Poor	Moderate	Moderate	Good
Di-butyl sebacate	Poor	Excellent	Poor	Poor	Poor	Good
Not approved for foodstuff use but included in this table to assist in comparison of performance properties.						
Di-2-ethylhexyl sebacate	Excellent	Excellent	Poor	Poor	Poor	Excellent
Poly propylene sebacate	Excellent	Poor	Good	Excellent	Excellent	Good

With di-2-ethylhexyl phthalate and di-iso-octyl phthalate we have plasticizers which are sufficiently resistant to water to be acceptable for foods of high water content, yet because of a detectable degree of toxicity and because of poor resistance to oils and fats, they are not acceptable for use with fatty foodstuffs. Here again, the mechanical properties of the p.v.c. composition would suffer. In choosing a plasticizer for a particular application, the solubility of the plasticizer in the particular foodstuff is therefore of importance. In the case of foods of high water content, obviously an initial selection can be made from the resistance of the p.v.c. compound to water. Examples of such applications are packaging and conveyor belting for fresh fruit and vegetables and tubing for aqueous beverages, such as fruit drinks, beer and milk. There is a wide choice of plasticizers for this type of application.

In the case of fatty foods, such as bacon, cheese, lard, margarine, butter and fish, resistance to olive oil is a suitable guide. Here, we would be considering both wrappings and conveyor belting. The choice of plasticizer is limited for this type of foodstuff and at best there is only "moderate" resistance to olive oil.

With porous foods, such as bread, cakes and biscuits, it would be necessary to conduct experiments on migration since, even if fat is not present, there would be a possibility of plasticizer "wicking" or migrating into the foodstuff. With cakes and the like, where there is an appreciable fat content, resistance to olive oil will serve as an initial guide.

Ageing and Low Temperature Properties

Ageing properties are of obvious importance. Where a plasticizer is poor in this respect, it would be permissible to use a small addition to a p.v.c. composition to achieve improvement in other properties, e.g. dibutyl sebacate could be used in formulating a p.v.c. composition for beer piping, if low temperature flexibility is of importance.

Low temperature performance may be significant only in special cases but its inclusion in Table III was thought to be advisable.

Odour and Taste

No statements have been made on these two very important properties. Certainly, there will be no highly obnoxious odour with the acceptable plasticizers listed in Table III. In plasticizers themselves these properties may vary according to methods of manufacture and storage. In the final p.v.c. composition, odour and taste due to volatile impurities in the plasticizer may have diminished or disappeared, whilst on the other hand odour and taste can develop in processing due to plasticizer hydrolysis and oxidation. Such breakdown may be reduced by improved stabilization. Odour and taste, therefore, can only be satisfactorily examined in p.v.c. composition which has been compounded under manufacturing conditions.

Cellulose Acetate Plastics

Until recently (15), it would not have been possible to usefully discuss plasticizers for this particular polymer, since the list of solvent plasticizers was confined to ethyl phthalyl ethyl glycolate. However, the list of solvent plasticizers for cellulose acetate, which are now deemed suitable for foodstuff applications, consists of the following:—Glyceryl triacetate, acetyl triethyl citrate, triethyl citrate, diethyl phthalate, ethyl phthalyl ethyl glycolate.

It is necessary to bear in mind the poor water

resistance of glyceryl triacetate and triethyl citrate, both of which are soluble in water at 25° C., to the extent of about 6g/100ml. The figure for acetyl triethyl citrate is about 0.7g/100ml. Volatility must also be considered, but this is not so important with thicker sheets and moulded sections, as opposed to thin films and sheets. With cellulose acetate compositions, ageing by volatility loss is not so marked as with p.v.c., since the diffusion rate of a plasticizer is much less. This is partly because the diffusion constant is dependent on plasticizer concentration. In cellulose acetate thin films and sheets, the total plasticizer concentration is of the order of 30% on the weight of polymer and less, whilst with p.v.c. higher concentrations are normally used. In the case of cellulose acetate moulding powders, where 40% to 50% total plasticizer is employed on the weight of polymer, the mouldings are usually of thicker cross-section than with thin film. For obvious reasons, it is necessary to employ solvent plasticizers in cellulose acetate moulding powders, also in films where vacuum forming and similar operations are applied. On the other hand, it is sometimes desirable to add non-solvent plasticizers having limited compatibility, in addition to the truly solvent types. Reasons for such additions could be the reduction of volatile losses, improvement in the surface finish of mouldings, improved resistance to water, improved dimensional stability or improved stripping behaviour of cast films. Suitable non-solvent plasticizers for such additions which are acceptable for foodstuff applications are:—Acetyl tributyl citrate and butyl phthalyl butyl glycolate.

Acknowledgments

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An Improved Shore-Hardness-Tester for Rubbers and Rubber-like Polymers

By V. BIRD

IN rubber-testing the Shore-hardness is the designation given to the resistance which a sample offers to the penetration of a steel needle subjected to a given spring-pressure and serves for the determination of the hardness of rubber-goods according to the DIN 53505.

The new improved Shore-hardness-tester shown in the illustration possesses all prerequisites for the carrying-out of rubber-testing according to the regulations laid down in the American ASTM Designation D 767–49b and in the West German Normblatt DIN 53505, and because of its compactness and portability is very well suited for the testing of soft-rubber, technical rubber articles, rubber goods of all kinds and products of Buna, as well as hard rubber, leather, and plastics exhibiting rubber-like characteristics.

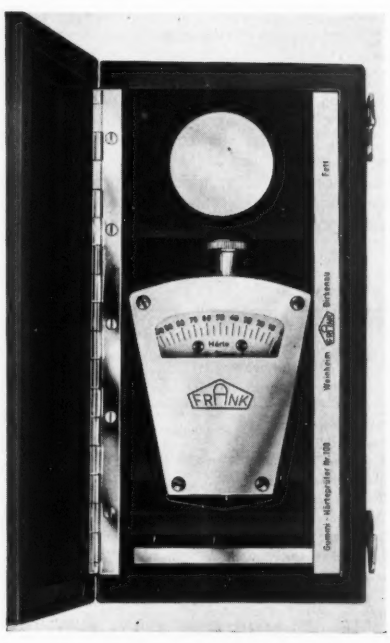
As a result of experience in working practice, it has been found advantageous to equip this apparatus with a drag-indicator, in order to use the tester when the scale is concealed from the operator during testing. This is sometimes the case when testing built-in components or inaccessible sections.

After lengthy development work a drag-indicator was built in on this testing apparatus, which is claimed to represent the ultimate perfection with regard to friction-freedom. By means of an ingenious construction it has been possible to successfully reduce the friction of the drag-indicator to such an extent that it is practically negligible. Especially to be stressed is the dust-proof construction of the hardness-tester, which has been in no way impaired by the building-in of the drag-indicator.

Method of Test

The testing itself takes place in such a way that the testing-apparatus is placed on the material to be tested, whereby the testing-point penetrates into the material. The depth of penetration is a measure for the softness of the rubber or plastic and can be read on the segment-shaped scale directly as a Shore-Hardness figure. The drag-indicator keeps the result on the indicator, so that it can be ascertained at any time. Laboratories of well-known rubber and plastics factories have worked experimentally with this apparatus and confirmed its utility in every way.

This new apparatus has been developed and brought on to the market by the West German company of testing instrument manufacturers, Karl Frank G.m.b.H., of Weinheim-Birkenau.



New Testing equipment built by Karl Frank, West Germany.

The Properties and Testing of Plastics Materials—Part 9 (Cont.)

Industrial Materials — Special Tests, Properties, etc., Polyvinyl Acetate, Polystyrene, Acrylics and Methacrylics, and Nylon

By A. E. LEVER,* A.I.R.I., and J. RHYS,† M.Sc.

Section 8. Polyvinyl Acetate

A REVIEW of the technology and applications of polyvinyl acetate emulsions (1) includes methods for determining pH value, particle size, and water resistance.

Considerable data is given in a discussion on the use of this polymer for adhesives to phenolic laminates, brass, bitumen, etc. (2). Methods of test are given.

Properties

Polyvinyl acetate is rarely used for mouldings but the following brief data is given (3):—

S.g.	1.18–1.20
Tensile strength, p.s.i.	to 5,000
Specific heat, cal./° C./g.	0.39
Thermal expansion, c.g.s. $\times 10^{-5}$	23–30
Heat distortion temp. ° F.	100
Dielectric constant, 60c/s	2.7–6.1
Power factor, 60 c/s	0.025–0.070
Water absorption (24 hrs.), %	3
Weak acids	Unaffected
Strong acids	Attacked
Solubility	Organic solvents

Polyvinyl Acetate (for solutions)

These differ in molecular weight and therefore in toughness, and softening point.

Gelva Type	*M.W.*	*S.P. ° C.*
1.5	—	65
2.5	13,000	81
7	33,000	106
15	60,000	131
25	100,000	151
Mowalith		
20	3,500	—
30	8,500	—
50	25,000	—
70	40,000	—
90	60,000	—

Polyvinyl Acetate Emulsions (unplasticized)

Solids, %	59–61
pH	4–5
Particle size-microns	1–2
Viscosity, 20° C. c.p.s.	3–10
S.g.	1.02–1.03
Free monomer, %	<0.5
Heat sealing temp., ° C.	100–125

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Section 9. Polystyrene

THE British Specification (1) divides polystyrene moulding material into two types:—

Type 1. General Purpose.

2. Electrical.

Methods of flow testing are not standardized but the Rossi-Peakes flow testing machine (2) is recommended.

Acceptance limits are as follows:—

	Type 1	*Type* 2
Methanol soluble matter, %	3.5	3.0
Volatile matter, %	1.5	1.5
Viscosity in 2% benzene solution, c.p.s.	1.9	1.9
Softening point, ° C.	90.0	90.0
Power factor, 1 mc/sec	—	0.0005
Permittivity, 1 mc/sec	—	2.7
Impact strength, ft. lb./in. (Izod.)	0.10	0.10

The mean impact strength of polystyrene is often of the order of 0.17 ft. lb./in. The coefficient of variation has been found to be of the order of 20–30%, so the value of acceptance is set at a low figure to allow for the large amount of scatter.

An American Specification (3) gives three types:—

Type 1. General purpose, modified.

2. Lubricated general purpose.

3. Improved heat distortion temperature.

	Methanol sol. matter, max. %	*Viscosity–1% soln. in toluene-poises*
Type 1	3.5	25
2	5.0	25
3	3.5	20

Injection moulded test pieces shall be used and the detailed requirements are tabulated together with the method of test.

An apparatus for isothermal compressibility measurements is described (4).

Tests were made (5) in tension, flexure and torsion at temperatures from 0–80° C. on stretched polystyrene rod, to study the effect of orientation on the mechanical properties. This is also discussed (6) together with methods for measuring the stress and crazing properties. There is a curvilinear relationship between stress and strain which rises with increasing rates of strain (15).

Methods for determining the particle size of polystyrene in latex are given (7).

There is a useful summary of some properties of this polymer (8) and the following data is interesting:—

	Heat Distortion
G.P. polystyrene	175–190° F.
Heat resistant polystyrene	203–230
Cellulose plastics	115–225
Acrylic plastics	150–210
Vinyl chloride-acetate copolymers	142–153

Two types of test for annealing are given:—

1. Kerosene Test

This consists in immersing the article for one minute in kerosene and then examining for cracking and crazing.

2. Thermal Shock Test

The article is filled with hot water (*ca* 190° F.), then replacing it with cold water after one minute. The cycle is repeated at one minute intervals. Articles are examined after 10 cycles.

Details of an American Commercial Standard (No. 168–50) for polystyrene wall tiles and adhesives are given (16). Methods of testing are given.

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Polystyrene Properties (8) (9)

	G.P.	*Heat Resist.*	*High Impact*
S.g.	1.05	1.04–1.06	1.05
Tensile strength, p.s.i. $\times 10^3$	6–7	7–10	4.5–5
E.B. %	1.5–2.0	1.5–2.5	15–27
Impact strength, ft. lb./in.	0.25–0.35	0.25–0.35	1.0–2.0
Flexural strength, p.s.i. $\times 10^3$	8–12	10–15	7–8
Heat distortion temp. ° F.	183–194	227–234	156
Hardness (Rockwell), M	65–80	70–80	(L) 75
Water absorption, 24 hrs. %	0.03–0.04	0.04–0.08	0.06
Dielectric const., 10^6 c/s	2.45–2.65	2.55–2.65	2.48
Power factor, 10^6 c/s	0.0001–5	0.0001–5	0.00054
Inflammability in./min. (17)	1.0	1.0	2.2
Injection moulding, temp. ° F.	300–700	375–575	400–450

* Consultant. † F. W. Berk and Co. Ltd.

Section 10. Acrylics and Methacrylics

AN American Specification (1) covers two types and two grades of cast methacrylate sheets, rods, tubes and shapes.

Type 1. G.P. having a heat distortion temperature of 60°–85° C.

2. A heat resistant grade with a heat distortion temperature of over 85° C.

Grade 1. With a finished surface highly polished.

2. With an unfinished surface, being frosted, sanded or otherwise unpolished.

A table of permitted tolerances for various thicknesses is given, together with specific requirements for various properties such as water absorption, shrinkage, tensile strength, impact strength, etc.

It is recommended that light transmission measurements are made with a photoelectric device.

The shrinkage test is for sheets only, which are heated at the recommended forming temperatures for 30 minutes, and the percentage shrinkage calculated.

Another Specification (2) covers methacrylate moulding compounds consisting of at least 51% methyl methacrylate, suitable for compression or injection moulding or extrusion moulding.

There are three grades also based on the heat distortion temperature at 264 p.s.i., which is determined according to (3). The heat distortion temperatures are respectively (1) 65° C.; (2) 72° C.; (3) 88° C.

Detailed requirements for moulded test pieces are given. The dependence of certain properties on the free monomer content is well known, and methods of determining this are given (4).

A paper is presented (5) with the object of demonstrating the complexity of the theory and practice of the testing of thermoplastics,

Properties (11)

Diakon Moulding Powders	LA–G.P. Grade	MC–Heat Resist.
Injection moulding temp. ° C.	180–240	230–270
Mould shrinkage in./in. ...	0.0006–8	0.0006–8
Tensile strength, p.s.i. ...	8,000–9,500	9,000–11,600
Young's modolulus in bend, p.s.i. × 10^5	3.8–4.5	4.4–4.9
Impact strength, ft. lb./in. (12)	0.25–0.57	0.28–0.76
Hardness-pyramid	17.2	21.5
Surface resistivity ohms ...	$>10^{14}$	$>10^{14}$
Volume resistivity ohm/cm...	$>10^{15}$	$>10^{15}$
Electric strength v/mil ...	240–265	262–298
Softening point (Vicat), ° C.	85–88	109–112
Density oz./in.^{3}	0.69	0.69
Water absorption (9 months) %	1.15	1.15
Dilute acids and conc. alkalis	Unaffected	Unaffected

arising from the close correlation between different properties of these materials. The mechanical properties of Perspex are discussed.

The stress–strain behaviour varies with the rate of straining (10).

Where acrylic sheet is used for glazing, it is important to determine the heat loss through the windows. Data is presented (6) for calculating the overall thermal conductivity, from which the heating and ventilating requirements can be assessed.

The loss of tensile strength of polymethyl methacrylate as a result of crazing has been investigated (7). The tests are described. Reference should also be made to (8).

A vacuum forming apparatus for producing flat biaxially-stretched discs about 10 in. dia. is described (9). Tests for stress-solvent (benzene) crazing is also given. (See also (8).)

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Section 11. Nylon

ONE American Specification (1) deals with injection moulding compound. It is essential that the moisture content of the powder, at the time of moulding, be less than 0.3%, otherwise the moulded articles will be inferior in appearance and physical properties. Drying under atmospheric pressure will not yield a powder of optimum properties. Satisfactory appearance is obtained with powder dried for not more than three hours at 100° C. A higher temperature, or longer exposure, causes deterioration. Details of the method for determining the moisture content are given. It involves the use of a diphenylene oxide bath.

A mandrel bend tester is illustrated, with details, which measures the ability of a standard $\frac{1}{8}$in. impact specimen to sustain bending around a $\frac{1}{4}$ in. mandrel.

There is a short section on the testing of nylon for certain purposes (2) including:—

1. Residual shrinkage.
2. Moisture regain.
3. Resistance to perspiration.
4. Identification of nylon yarn. See also (3).

The moisture content of nylon moulding powder may be estimated (8) by placing some nylon granules between glass cover plates on a hot plate maintained at 50° F. above the melting point of the nylon. The molten nylon is then examined for the extent of frothing or bubbling. Dry nylon should not show any bubbling. The degree of bubbling increases appreciably with moisture content.

Quantitative tests for identification of Perlon L., T. & U., in admixture with other fibres, are reviewed (4). For quantitative estimations, concentrated formic acid was found to be the most suitable solvent.

An investigation of the effect of the speed of testing on the strength properties of plastics is reported (5) and it is noted that the yield-point elongation of nylon increased three-fold for a 10,000-fold increase in the speed of testing (6).

A paper of importance has been published (9) dealing with the influence of heat and of swelling agents on nylon 66 yarns. It should be studied by those interested.

Nylon A.F. Moulding Powder (8)

Density 20° C., oz./in.^{3}	0.66
Coefficient of expansion, % vol. from room temp. to MP	16
Tensile strength, p.s.i. 20° C. ..	10500
160° C. ..	7000
Impact strength (Izod.), ft. lb./in. 20° C.	3.0
110° C.	15.0
Shrinkage is a function of moulding conditions:—	
Direction of injection in/in. ..	0.018
At right angles to direction of injection	0.014
Moisture content %:—	
25° C. 20% RH	0.9
70% RH	4.5
100% RH	7.6
Volume resistivity, ohm/cm × 10^{12}	5–10
Electric strength, v/mil.	300–400
Power factor, 10^6 c/s	0.02
Permittivity, 10^6 c/s	3.6
Soluble	Phenol, formic and oxidizing acids.
Not attacked by	Esters, ketones, alcohols and common organic solvents, alkalis.

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5. A.S.T.M. Symp. on Speed of Testing, June, 1948.
6. *J. Coll. Sci.*, 1947, **2,** No. 1, 193.
7. I.C.I. Ltd.
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BRITISH PLASTICS INDUSTRY

Record Output and Exports in 1956

THE British plastics industry had another record production and export year in 1956, it is announced by the British Plastics Federation. Output, which has been more than doubled since 1950, reached about 335,000 tons, an increase of more than 10,000 tons compared with the 1955 total of 324,000 tons. The increase is at a slightly reduced rate compared with 1955, output for 1954 having been 274,000 tons.

Thermoplastics materials including p.v.c., polythene and polystyrene, were again responsible for more than 50 per cent. of the output. Expansions now in progress will mean still higher production capacity for various plastics this year and subsequently.

Exports of plastics materials alone in 1956 amounted to nearly 98,000 tons, valued at over £26m., a rise of nearly 13,000 tons, valued at over £3m., compared with the 1955 figures, the previous highest. The increase in exports is at a slightly higher rate than in 1955 (1954 exports, over 73,000 tons, value £20½m.).

The tonnage exported is approaching five times that for 1947 (21,000 tons) and more than 20 times that for 1938 (4,300 tons).

The exported materials consist of moulding powders, resins, sheet, rod, tube, film and foil, but do not include finished components and parts, large numbers of which are used in finished products such as domestic ware and parts for the aircraft, electrical and motor industries.

Australia (with imports valued at over £2.75m.) remained the best market, and India (over £2m.), France (£1.6m.), Netherlands (£1.5m.), South Africa (£1.4m.), Sweden (£1.3m.), Italy (nearly £1.2m.), and Denmark (£1m.) were other substantial buyers.

Patent Review

The following abstracts have been made from specifications at the Patent Office, with the permission of the controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 3s. 0d. each (including postage).

B.P. 762,339. Manufacture of brooms. K. B. Seong.

A broom head of plastics with sweeping elements of natural material. The head incorporates wood waste and/or parts of the sweeping elements as fillers.

B.P. 762,412. Rigid surgical supporting means. P. Leslie, F. J. R. Batten, C. W. Smith.

Replacing plaster casts by layers of fabrics containing over 90% cellulose acetate. They are applied to the part of the body to be immobilized and treated with a solvent solution for shortening the threads. Thereafter a strong solution is used for dissolving the threads into a layer which on drying, forms a rigid support.

B.P. 762,451. Sealing or welding of thermoplastic materials. A. H. Bland, A. H. Bland (Engineers) Ltd.

Heat is transmitted to polythene sheets by means of a hot jaw (200 deg. C.) in the form of a rib and conducted through the sheets to a cold jaw (room temperature) between which the sheets are pressed. Both jaws are good heat conductors.

B.P. 762,457. Artificial tooth. M. Marder (France).

A facing with a layer of white metallic gauze embedded in its rear surface to act as a screen for concealing the support from the front of the facing.

B.P. 762,462. Synthetic resinous moulding materials. L. N. Phillips. To: National Research Development Corp.

A heat convertible resin mixture stable at room temperature comprising a monohydric phenol aldehyde resin and a polyhydroxy phenol aldehyde resin to be used as an impregnant for reinforced products comprising fibrous, felted or woven components.

B.P. 762,471. Bonding processes using urea-formaldehyde resin glues. Aero Research Ltd., F. Bird.

In the manufacture of plywood and chipboard, urea-formaldehyde resin glues are used, which, on heating, give off formaldehyde vapour of unpleasant odour. In order to remove such odour, ammonium carbonate (3%) or bicarbonate (5%) are added, which do not affect hardening.

B.P. 762,509. Apparatus for injection moulding of plastic material. To: Specialites Alimentaires Bourguignonnes (France).

Molten material does not pass into the mould at a uniform speed and pressure. Material flowing at a low inital speed tends to set, which is a considerable drawback if the pieces are small. The new apparatus has a heated cylinder constituting a heated feed chamber and operates with intermittent feed and delivery by means of piston and piston valve whereby the material flows through the piston to the injection chamber on reciprocation of the piston

B.P. 762,525. Machine for injection moulding of plastic articles. To: Specialites Alimentaires Bourguinonnes (France).

An automatic multi-mould machine mainly for extra light casting parts of polyethylene, polyamides, etc. Pairs of upper and lower mould carriers are arranged on an intermittently revolving table having a series of stopping stations. Head plates are raised and lowered in succession and liquid material supplied from an injection chamber. The sprue is automatically removed and the moulded article ejected.

B.P. 762,528. Pressure point pads for bed patients. H. A. E. Talley.

A rectangular vinyl plastic pad divided into expandable cells to shift the support of the patient.

B.P. 762,567. Closing means of plastic for metal or other vessels fitted with inner liners of plastic. G. Marcenaro (Italy).

The closing is effected by making the flexible plastic (polyethylene, polyvinyl chloride, polystyrol) lining integral with a plastic bush screwed in the usual metal plug to prevent contact between the contents and the material of vessel or closure.

B.P. 762,581. Compressible floor tile and method of laying the same. E. S. Robbins (U.S.A.).

Especially satisfactory are polyvinyl chloride tiles with plane side faces except for minute ridges, a series of ridges or depressions on the bottom in grid-like arrangement and a smooth upper face.

B.P. 762,586. Apparatus for use as an educational aid. T. L. Beynon. To: Hilary Page " Sensible " Toys Ltd.

A number of blocks of different sizes corresponding with the numerals on them which may be arranged in a frame.

B.P. 762,589. Holder for supporting scanning coils of cathode ray tubes. P. H. Phillips. To: Plessey Co., Ltd.

The holder may be moulded of semi-rigid polyvinyl chloride.

B.P. 762,592. Compositions of solid polymers of ethylene. W. G. Oakes. To: I.C.I. Ltd.

A very soft grade (greater than 200) polythene (25%–75%) and a very hard grade (less than 0.2) polythene (75%–25%) are mixed to obtain a material for extrusion at a high rate of shear using only a fraction of the power otherwise required.

B.P. 762,607. Sealed packages. H. R. Stilton. To: Radio Heaters Ltd.

Flexible polyvinyl chloride tube folded concertina fashion to prevent mixing of contents of the various lengths until the tube is unfolded.

B.P. 762,658. Buttons or similar disc-like articles and dress ornaments made therefrom. C. S. B. Potbury.

B.P. 762,690. Process for the recovery of synthetic polyester scrap. W. Muench, L. Notarbartolo, L. Spano. To: Perfogil Societá per Azioni.

It has been found that without any significant pollution and with almost quantitative yield, desired methyl or ethyl esters of the component acids can be recovered and also the component alcohols by heating the polyesters in mono- or polyhydric alcohols, then reacting the solution with methanol or ethanol in an acid or an alkaline medium.

B.P. 762,694. Moulded interlocking slates. E. G. Lang, C. T. Lang.

B.P. 762,769. Refractors for street lighting lanterns. R. W. Stevens. To: Metropolitan-Vickers Electrical Ltd.

The prisms are so arranged and spaced apart at their bases that interception of the paths of light emanating from adjacent prisms is avoided.

B.P. 762,821. Copolymers of phenylpolysiloxane and oil-modified alkyd resins. To: Union Carbide & Carbon Corp. (U.S.A.).

B.P. 762,863. Methods of treating thermoplastic material. General Electric Co., Ltd., L. J. C. Connel.

The material is differentially softened by radiant heat by either locally increasing the rate of heating or by applying locally a material of high absorption factor for the radiation used. Perspex with black paint lines was softened along these lines and could then easily be folded.

B.P. 762,872. Bonding of glass or inorganic glass-like substances to resins. Leda Chemicals Ltd., H. Yarrow.

Glass fibre laminates are bonded with a quaternary ammonium salt applied as an aqueous solution in form of a film.

B.P. 762,881. Resin solutions suitable for producing bakable coatings and process for making such solutions derived from resinous polyhydric phenol derivations containing at least two ethylene oxide groups. To: CIBA Ltd. (Switzerland).

B.P. 762,897. Surgical splints and materials for and methods of making same. J. T. Scales. To: National Research Development Corp.

It has been found that the sponge-like material made from polyurethane formed into a foam is peculiarly useful as the lining material.

B.P. 762,906. Composite articles including porous members. L. A. Hodge. To: Birmingham Small Arms Co., Ltd.

Combination of a thermoplastic member with a porous metallic filter plate for sealing off welds.

B.P. 762,933. Platform sole shoe and method of making such shoe. To: Mishawaka Rubber and Woollen Manufacturing Co. (U.S.A.).

A composite sole having a thick platform layer of cushiony material. The sole and foxing unit is formed in a mould using polyvinyl chloride resins (" Geon 121 "; " Vinylite QYNV ") in a plasticizer, e.g., 125 part plasticizer per 100 p.v.c. for a basketball sole.

B.P. 762,967. Joint for use with plastic piping. S. Pepper.

A rigid brass body with extensions fitting into the polythene piping. Annular wedge-shaped sleeves of soft copper clamp the ends of the piping over the extensions under ring nuts screwed on to the brass body. To prevent creep the extensions have shallow grooves of buttress shape.

B.P. 763,016. Holder for cigarette packets. To: W. G. Luxton.

Fits closely over the packet, has apertures for pushing the packet and for gripping a cigarette and an inwardly directed shoulder to hold the inserted packet.

B.P. 763,019. Brushes. E. L. H. Cosby, Jr. To: G. B. Kent & Sons, Ltd.

A paint brush with nylon filaments secured as by staples in the form of lines of bristle tufts in (converging) rows of holes in a flat handle so as to obtain a flat brush. The form permits a reduction of manufacturing costs.

B.P. 763,156. Apparatus for cooling sick persons. C. C. F. Cuvier (France).

Using a bag of polyvinyl chloride or polyethylene, in which the patient may be attended

to through airtight closing " Plexiglas " ports.

B.P. 763,211. Dropping and pouring insert for liquid containers such as bottles or the like. H. Bruene (Germany).

A dropping and/or pouring insert and a stopper both made of polyethylene. The insert has inclined air inlet and liquid outlet tubes in stepped position.

B.P. 763,212. Stoppers for the mouth of bottles, containers, phials or the like. H. Bruene (Germany).

B.P. 763,234. Distributor caps for the ignition systems of internal combustion engines. J. B. C. Du Mont.

A transparent moulding preferably of polymethyl methacrylate.

B.P. 763,240. Synthetic plastic filaments and method of making same. To: Firestone Tire & Rubber Co. (U.S.A.).

An oriented crystalline monofilament for the production of pot cleaners to replace metal cleaning pads.

B.P. 763,241. Sliding clasp fastener arrangements. H. G. Stickel (Germany).

Decorative members assembled along the free edge of one of the fastener stringers cover the coupling means and the holding means laterally when the fastener is closed.

B.P. 763,254. Apparatus for the production of bags or liners of thermoplastic material. A. A. Ellison.

The end of a tube of a polythene film is stretched over a rigid former of slightly larger diameter than the tube leaving a short length of tube projecting beyond the stretched tube end. This length will then lie flat on the former so that a flat end piece can easily heat sealed on to the tube end by a pressure head.

B.P. 763,292. Transport containers. A. Mauser (Germany).

Removal of polythene bags containing material which, after being poured in, solidifies, from transport containers without damaging the bags. The containers (not of plastics) are made to be ripped open.

B.P. 763,380. Polystyrene. R. N. Haward, A. N. Roper. To: Styrene Products Ltd.

Polystyrene of high impact strength made by intimately mixing solid polystyrene in the form of large particles with synthetic rubber latex and polystyrene latex and drying the mixture.

B.P. 763,436. Structural materials having one or more cellular or embossed courses or layers. J. Pfistershammer (Switzerland).

The basic structure is a sheet deformed from the flat condition by stamping, pressing, rolling so as to develop dome-shaped cells having a curved cross-sectional contour in every direction. The cells are arranged so as to avoid straight lines. Laminates with or without fillers and cements may be produced. Among the useful sheet materials, polyamides are mentioned. For shaped bodies as, e.g., vehicles, aircraft, water craft, helmets, etc.

B.P. 763,476. Portable respirators. J. T. Scales, A. B. K. Wilson. To: Medical Supply Assoc. Ltd.

To be used instead of cabinet or tank respirators. The respirator cuirass shell is made as a (shatterproof transparent) moulding of a polyvinyl chloride and acetate copolymer material.

B.P. 763,583. Method of and means for forming hollow articles from thermoplastic material by blowing. F. T. Parfrey.

Plastic (polyvinyl chloride; polythene) bottles are made by blowing cold air under pressure into a length of heated tubing over a mandrel and in a mould and exhausting the air from within the formed article. The air effects cooling and is blown in and exhausted in a continuous manner and thus shortens the " waiting " time.

B.P. 763,584. Method of and means for forming hollow articles from thermoplastic material by blowing. F. T. Parfrey.

This refers to the method and the operation of a machine for carrying out the method as basically described in 763,583.

B.P. 763,604. Synthetic leather. To: E. I. Du Pont de Nemours and Co. (U.S.A.).

It has been discovered that a water vapour impermeable composite sheet (e.g., nylon fibres impregnated with a relatively extensible thermoplastic polymer binder) can be made permeable to water vapour and air by stretching so as to impart to it " breathing " qualities.

B.P. 763,614. Paint brushes. D. M. Callow, J. Bearn. To: D. M. Callow.

With a hinged head. The hinge may be a plastic sleeve.

B.P. 763,646. Patent-leather-like finish on polyvinyl chloride sheet materials and process of making same. To: E. I. Du Pont de Nemours & Co. (U.S.A.).

By adding a smooth film which is dissimilar to the exposed surface of the sheet material (by passing both between heated pressure rolls). The film is later removed.

B.P. 763,649. Pressure-sensitive adhesive marking tape. To: Minnesota Mining & Mfg. Co. (U.S.A.).

Instead of roughening the exposed surface of a regenerated cellulose backing for enabling marking with a pencil, a thin coating composition is used comprising fine mineral powder in an aqueous solution of casein and shellac.

B.P. 763,650. Aprons or pinafores. J. L. Lindsay.

With a detachable rear lining of waterproof sheet material, e.g., synthetic resin material.

B.P. 763,748. Method and apparatus for casting plastic reinforced pipe. To: Reflin Co. (U.S.A.).

An insulated electric oven carries rotating casting cylinders containing a liquid plastic charge. During spinning, the cylinders are raised to the proper temperature, the plastic material is distributed by centrifugal action and sets. The cast pipe is then withdrawn. For reinforced " Fiber-glas."

B.P. 763,812. Manufacture of synthetic resin pre-coated foundry sands for the purpose of shell moulding. Blackburn & Oliver Ltd., J. Pollack.

A mixture of wet sand and not more than 20% (4%–10%) finely divided, fusible, solid, thermosetting phenol-formaldehyde resin of a particle size of from 0.3 to 20 (8–10) microns.

B.P. 763,901. Street sign. J. Frager (France).

A hemispherical opaque housing with a peripheral indicator strip of transparent material.

B.P. 763,904. Turntable structures. M. Keim (U.S.A.).

A platter support, tray, game board with a moulded base of a paper laminate or of " Masonite."

B.P. 763,907. Apparatus for producing a helix of a thermoplastic substance. W. Berberich (Germany).

Including a hot water bath and a spindle with guide parts having the pitch of the helix to be produced and means for cooling the helix (for use in binding loose-leaf books).

B.P. 763,928. Method of making plasticized vinyl resin sponge. To: United States Rubber Co. (U.S.A.).

By mechanically frothing an intimate mixture of a plastisol (polyvinyl chloride and copolymers of vinyl chloride and a monomer and a high-boiling organic liquid plasticizer), a non-ionic surface-active agent, and certain alkali metal salts, whereby the surrounding air is incorporated in the mixture. The resulting froth is heated to fuse the resin particles, then cooled.

B.P. 763,939. Shaped polymide articles and method of forming same. To: Polymer Corp. (U.S.A.).

The articles are formed by conventional powder metallurgical tools. Nylon powder (scrap or virgin) of a particle size of less than 40 microns (about 10 microns) is compressed to the desired shape and heated to sintering temperature. It may then be annealed. Fillers may be added (metal powders, abrasives, etc.). For resistors, capacitors, brushes, pencils, bushings, bearings, textile guides.

B.P. 763,940. Polyamide powder compositions useful in making moulded articles. To: Polymer Corp. (U.S.A.).

Linear polyamide particles prepared under non-oxidizing conditions of a particle size below 40 microns admixed with a filler constituting not more than 85% of the total volume. As fillers are specially mentioned molybdenum disulphide, carbon, polytetrafluoroethylene.

B.P. 763,978. Hydraulic pressure producer for injection moulding machines. To: Eckert & Ziegler G.m.b.H. (Germany).

The control of the fluid pressure medium is effected by a two-stage or two diameter piston in a double acting cylinder. In the first part of the stroke the mould closes and is set in position against the injection cylinder, in the second part injection takes place.

B.P. 764,024. Moulding compositions and articles produced therefrom. To: American Cyanamid Co. (U.S.A.).

A plastic material (vinyl resin) which normally tends to accumulate static charges of electricity after or during moulding and an anti-static agent comprising a particular quaternary ammonium compound.

B.P. 764,086. Fabric-like material composed of adhesively-bonded fibres. To: Chicopee Mfg. Corp. (U.S.A.).

Refers to the stretching and rebonding of an oriented web of prebonded textile fabric to obtain a non-woven substitute for woven gauze.

B.P. 764,091. Porous materials of low density produced from diisocyanates and polyesters. To: Farbenfabriken Bayer A.G. (Germany)

B.P. 764,123. Toothbrush holders. S. E. Lovett.

A wall bracket with two container halves hinged to it, for enclosing the brush head, the closure means being operated by pressure of the toothbrush.

B.P. 764,179. Food mixers. To: Hoover Ltd. (U.S.A.).

With a flexible mixing disc having an undulating periphery and made of nylon or polyethylene fabric.

B.P. 764,225. Method of producing moulds. To: Metallgesellschaft A.G. (Germany).

Instead of machining the moulds from steel or by cold sinking a steel model into a steel block (not possible for many shapes), a mould negative is made by sinking a model of steel or other material into a blank of zinc alloy at elevated temperature. For working up organic materials in plastic or flowing condition.

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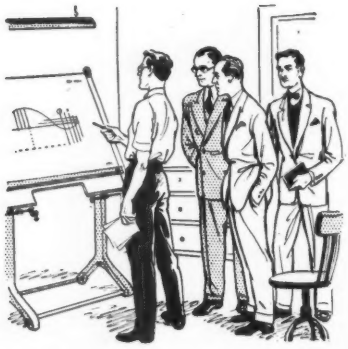

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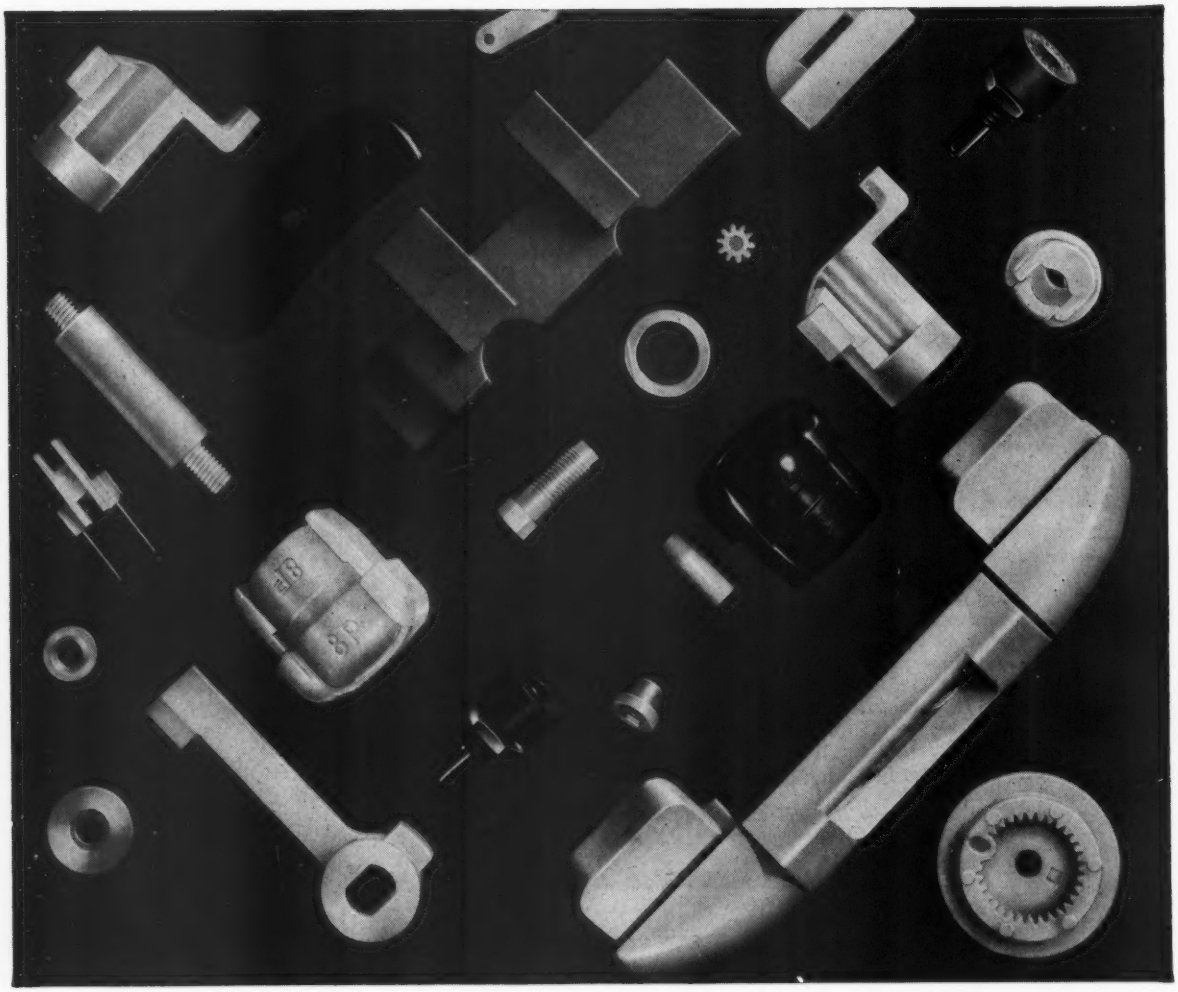

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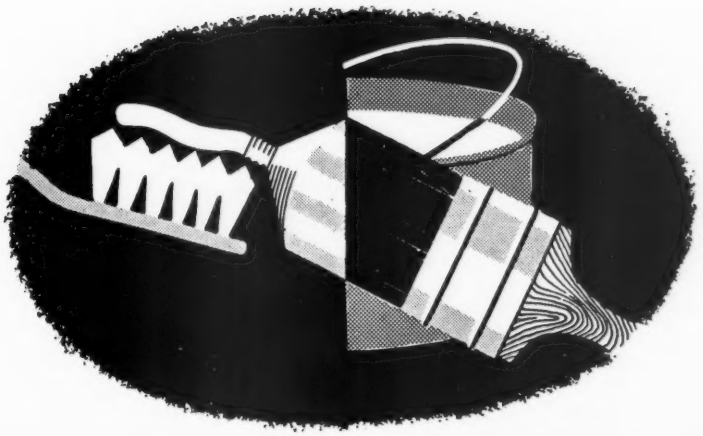

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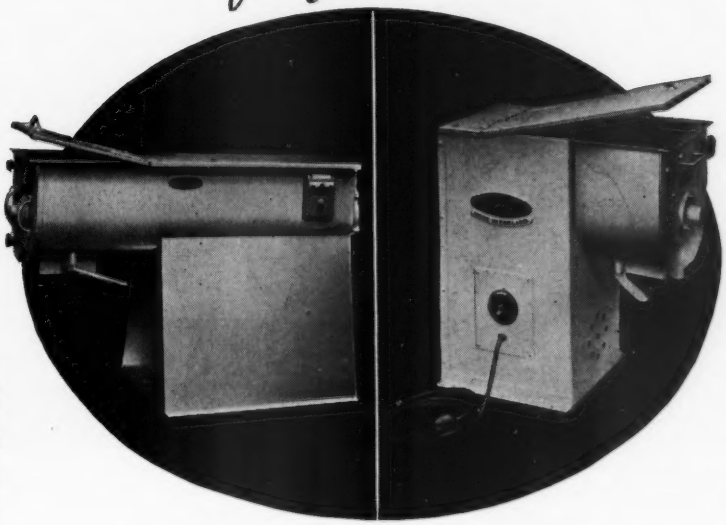

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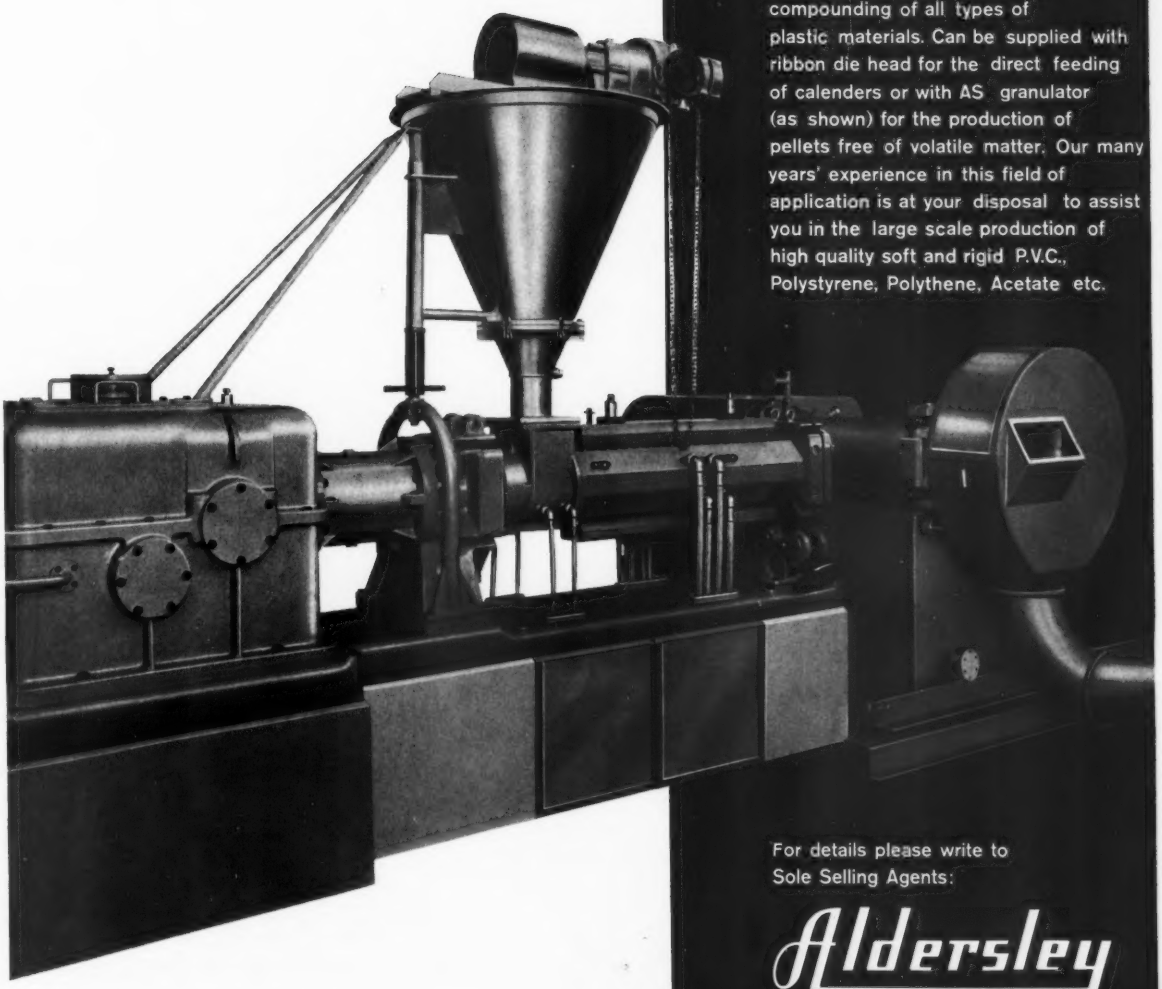

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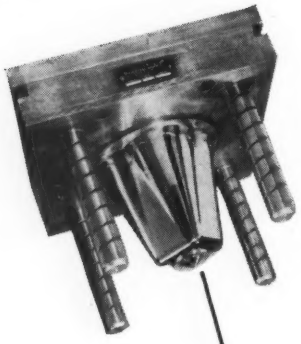

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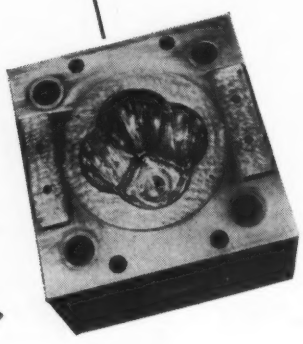

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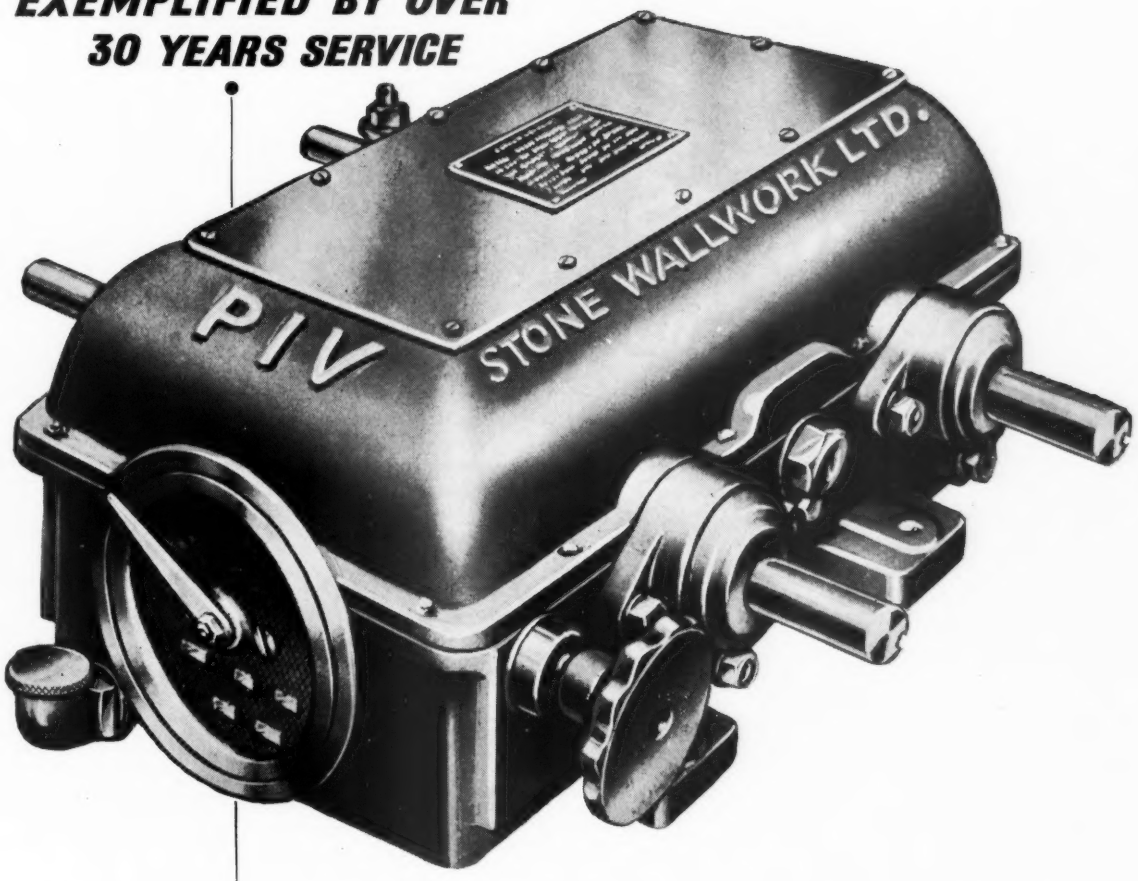

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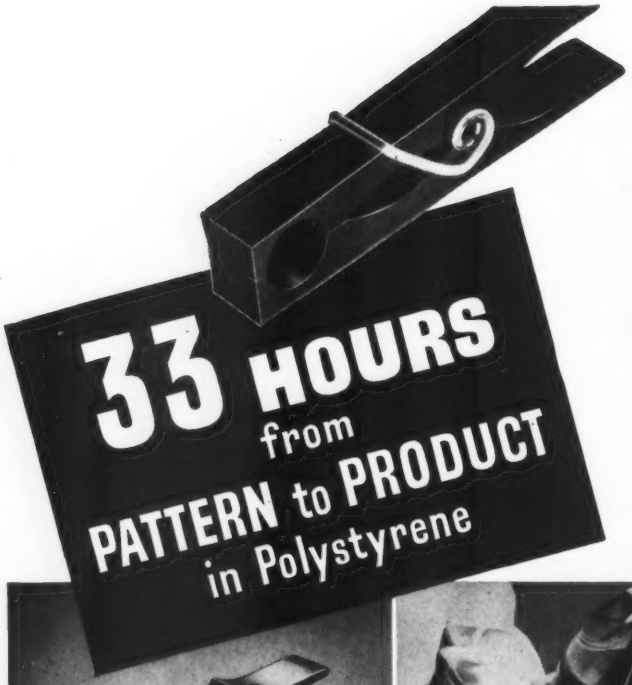
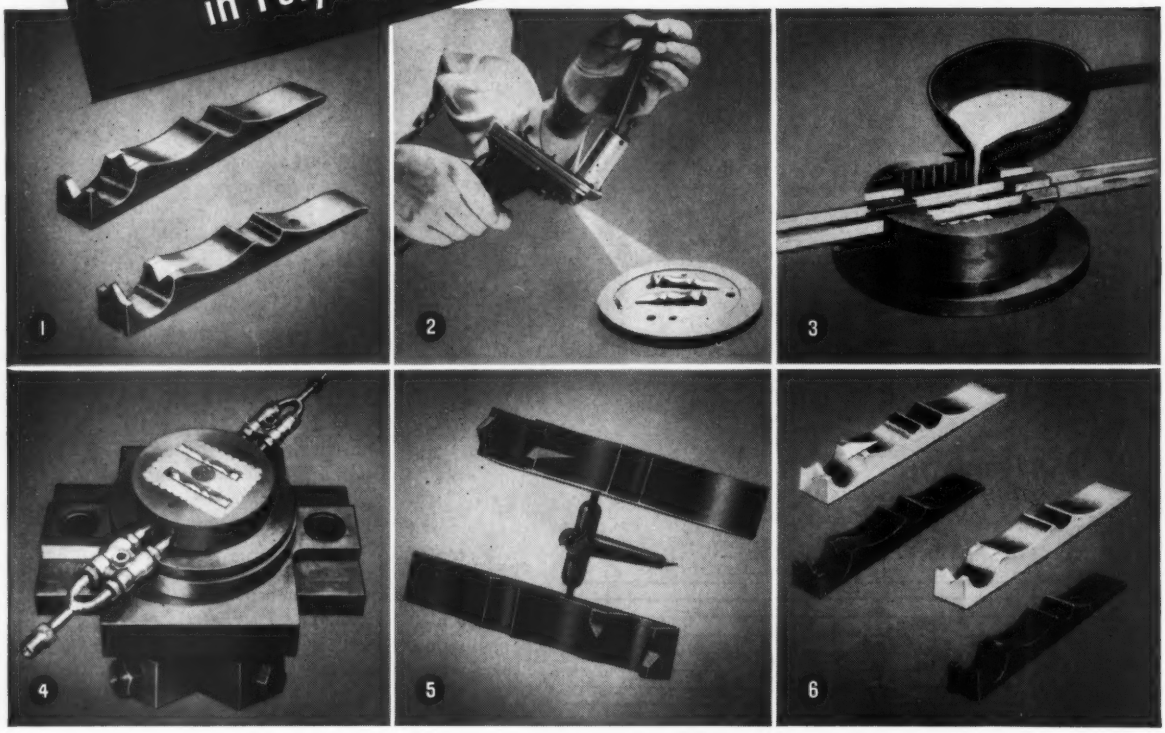


For the First Time!

By courtesy of Messrs. S. Smith & Sons (England) Limited, we illustrate manufacture of injection mould for production in Polystyrene in a total time of 33 hours and a fraction of cost of machining.



1. Aluminium master pattern.
2. Spraying pattern with Cerrocast.
3. Pouring molten Cerrocast to back sprayed shell and embed water cooling tubes.
4. Complete mould. 5. Typical shot.
6. Comparison of patterns and mouldings.

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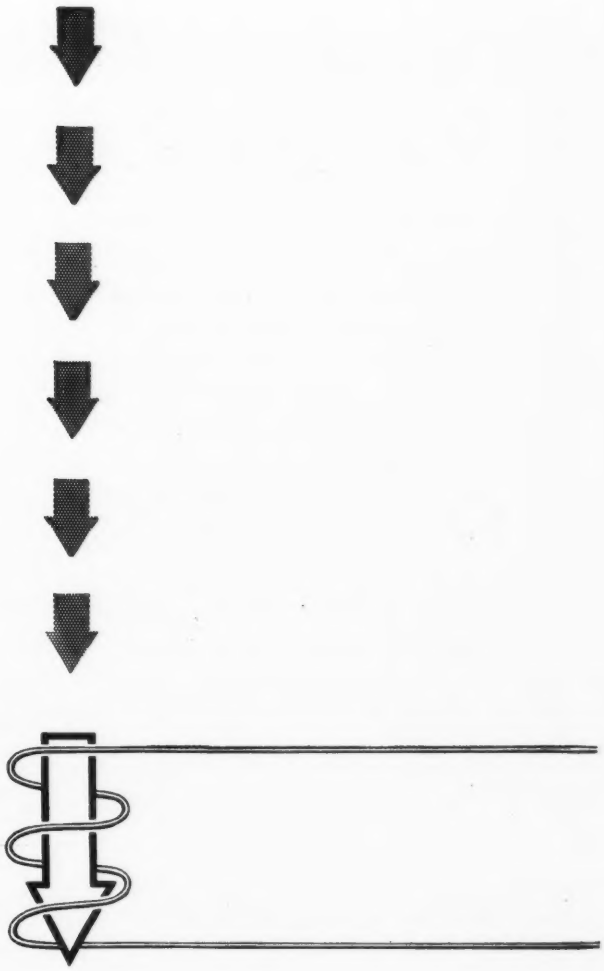

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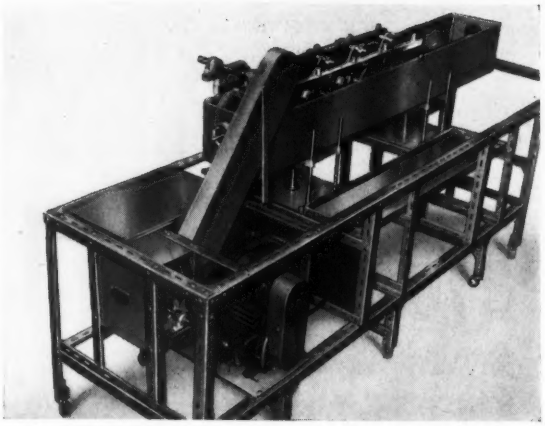

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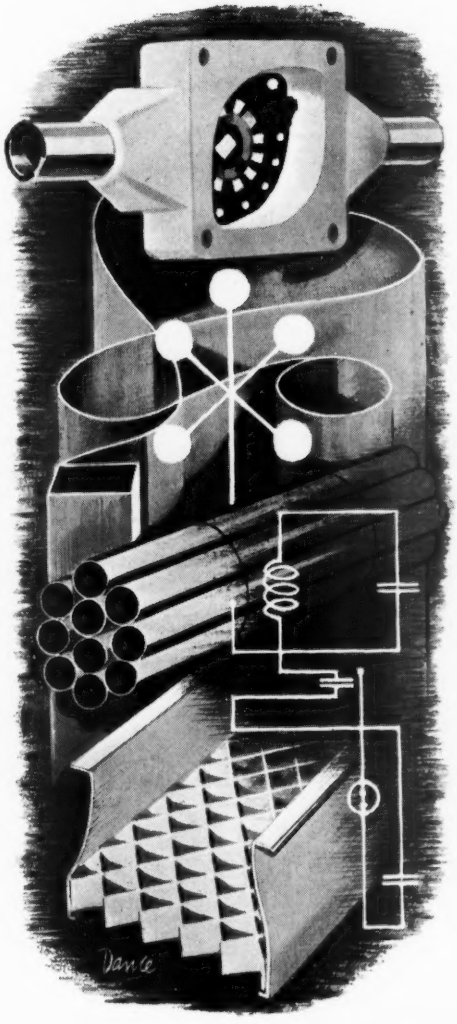

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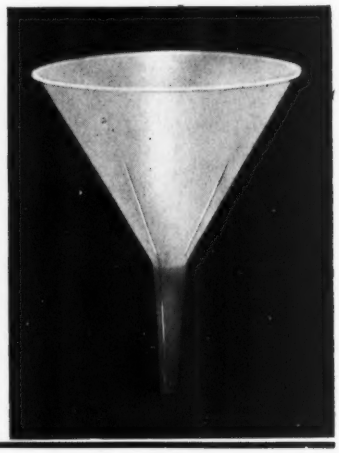

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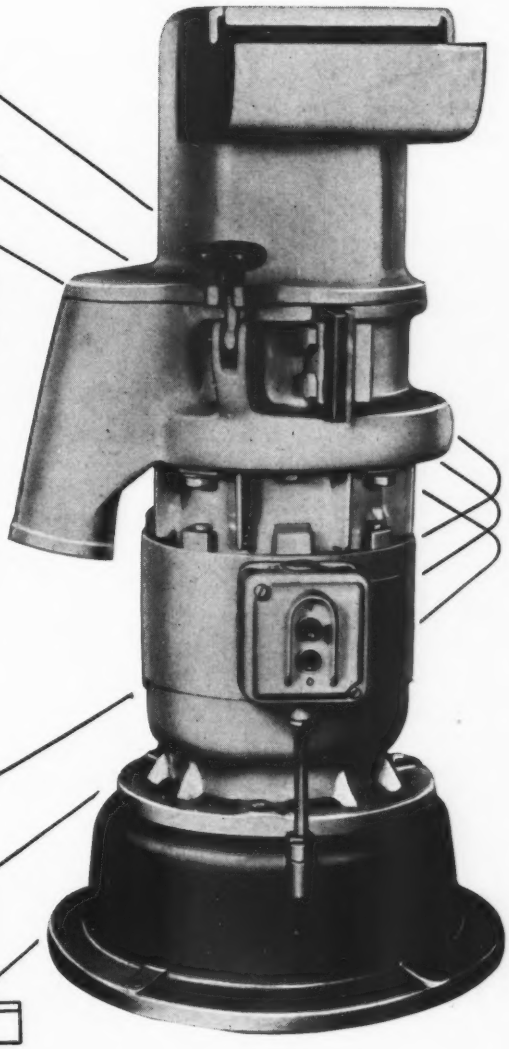

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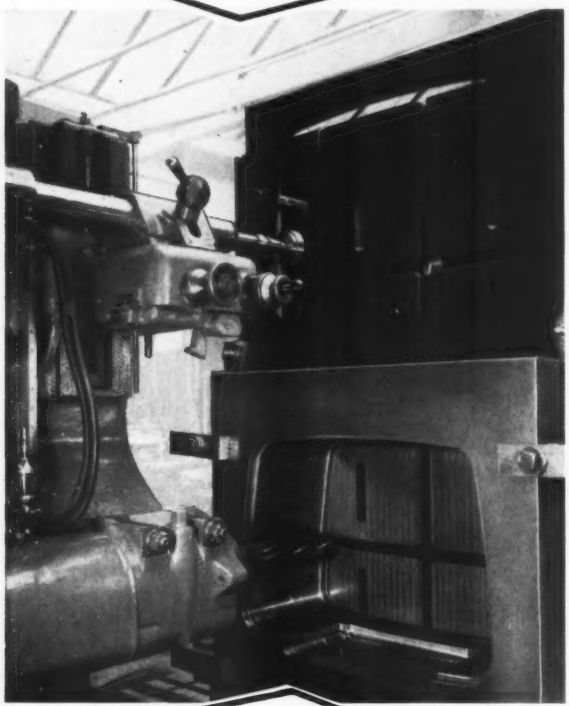

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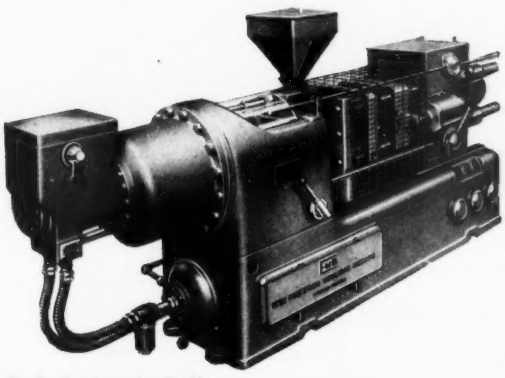

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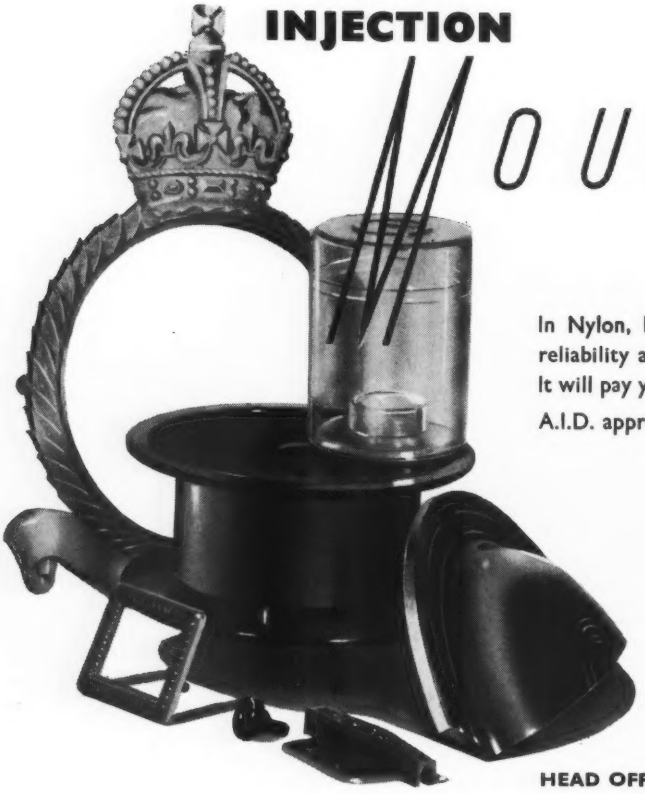

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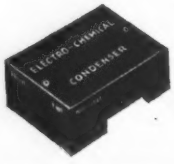

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Quality controlled 'deeglas'

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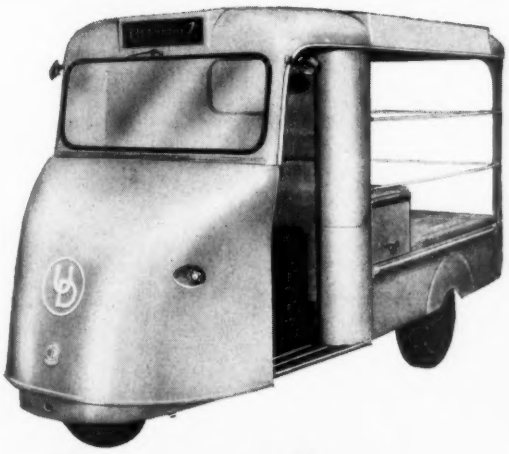

This all-plastic milk float, manufactured by Mickleover Transport Ltd. for United Dairies employs **deeglas** chopped strand mat as its sole reinforcing material.

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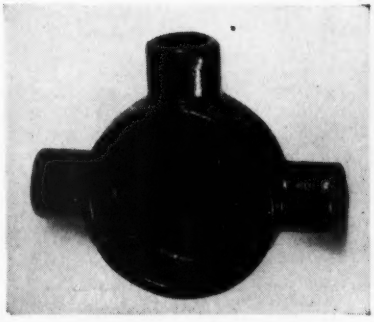
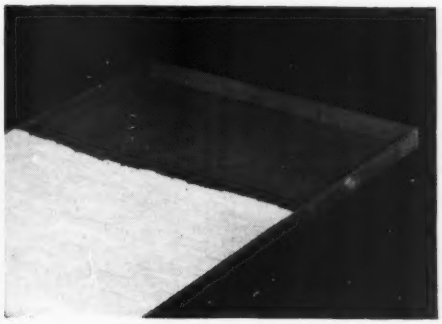


Conduit Junction Box H.D. Polythene coating insulates and gives complete corrosion protection.



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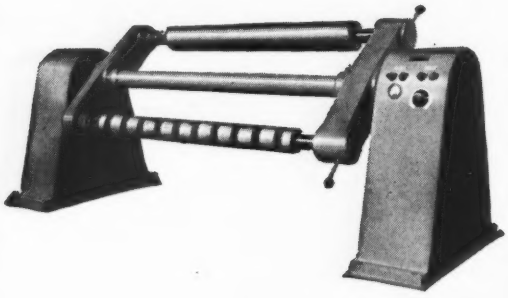

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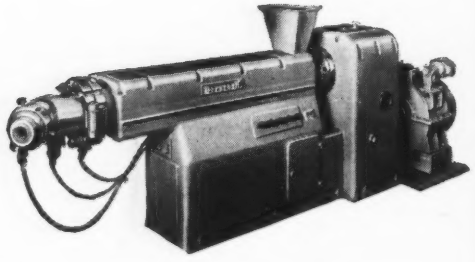

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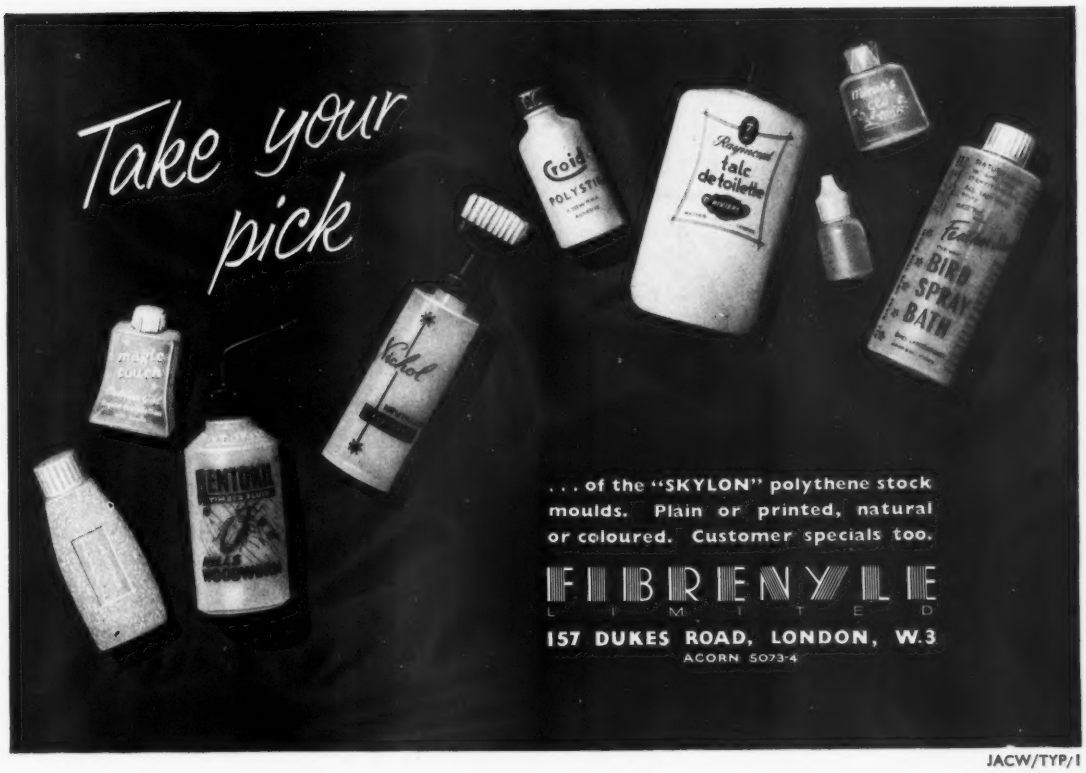

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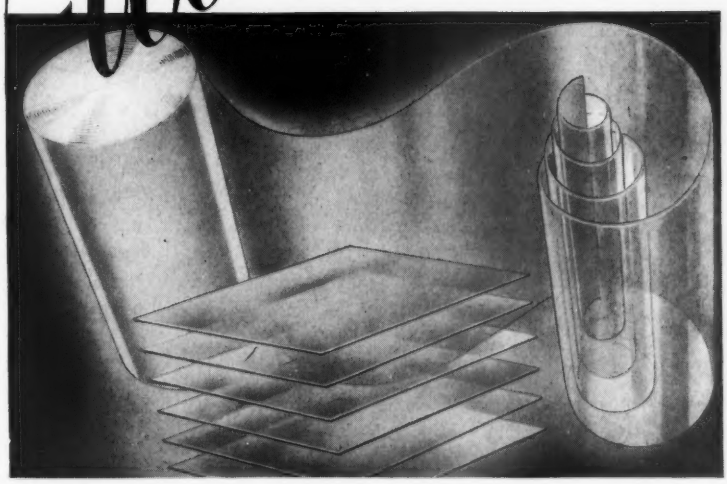

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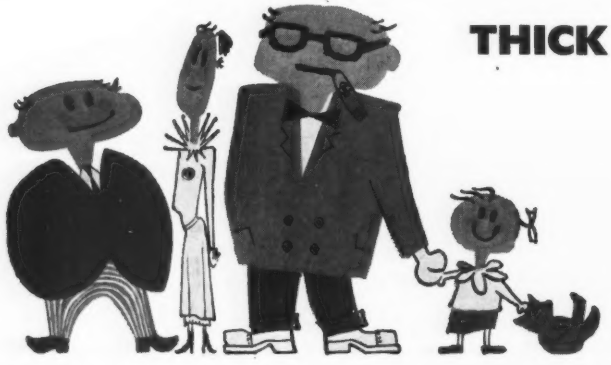

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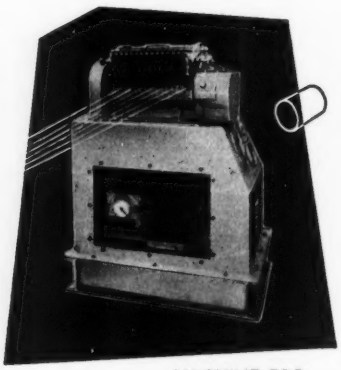

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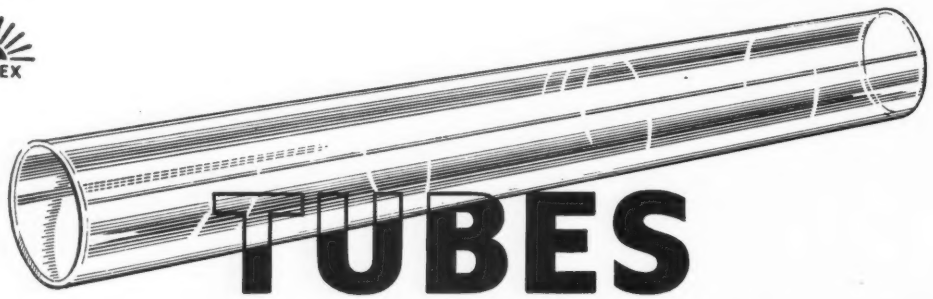

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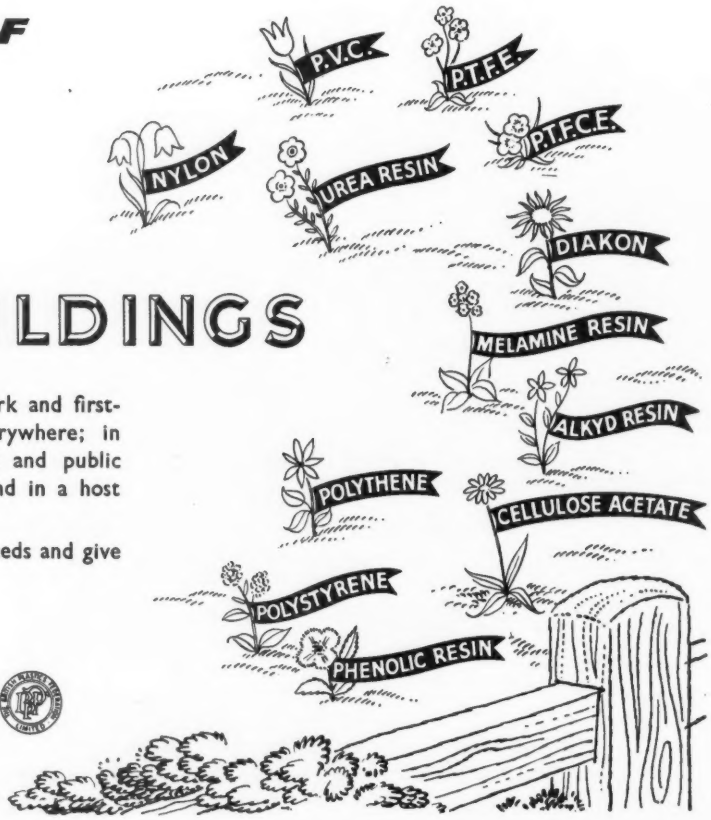

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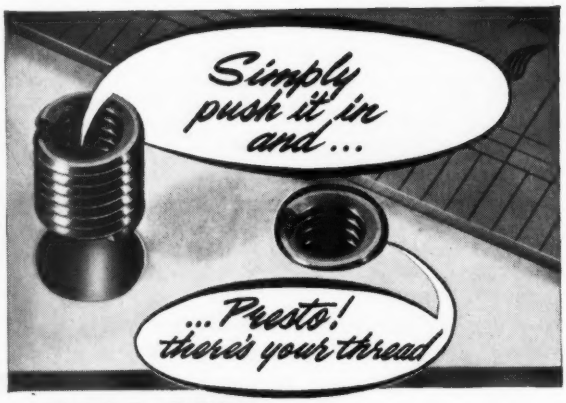

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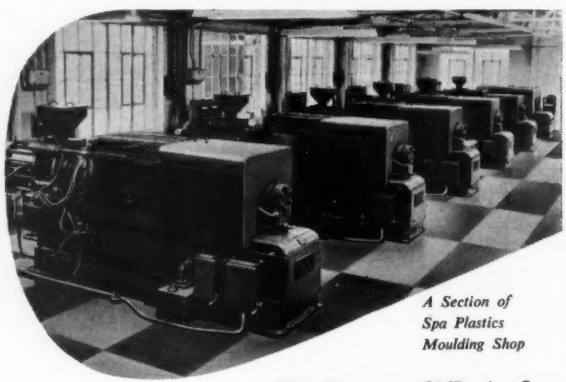

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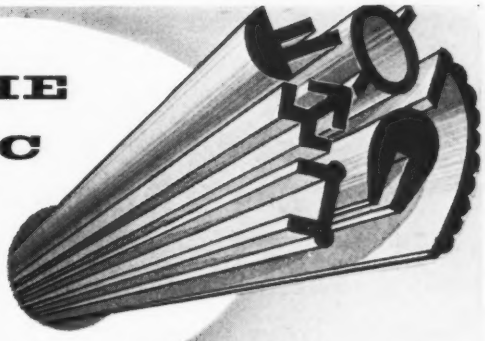

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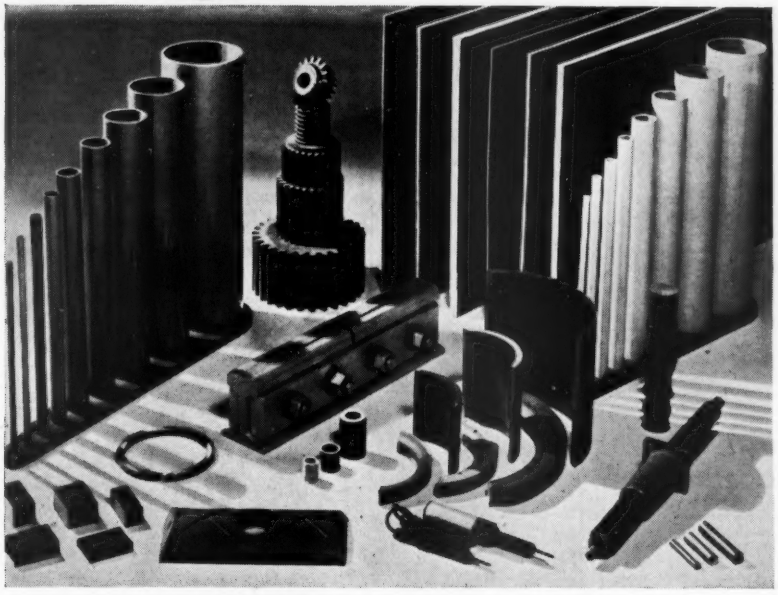

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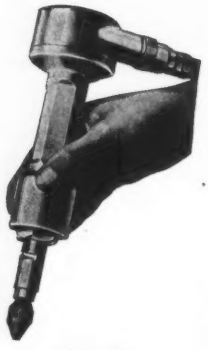

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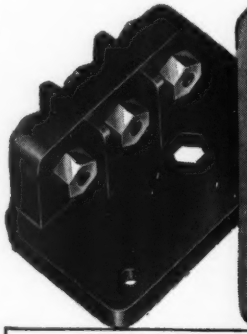

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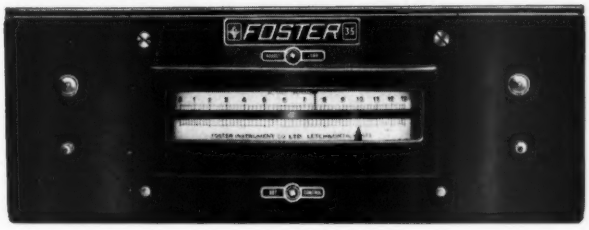

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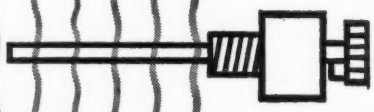

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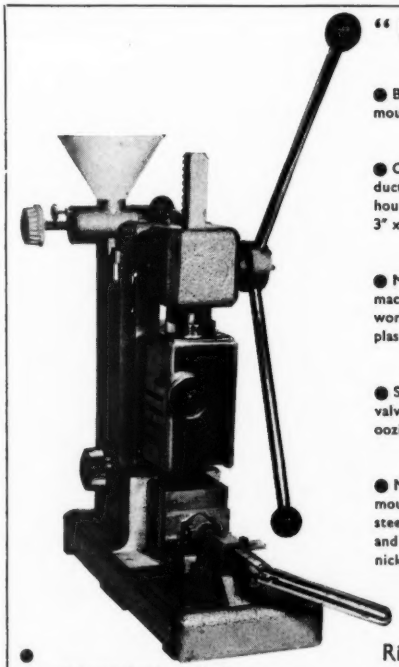

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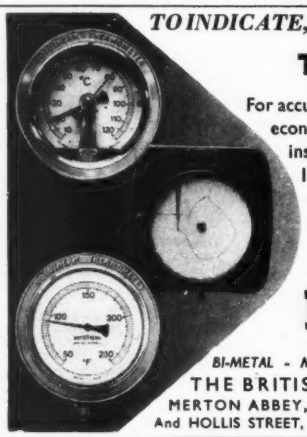

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HEAD OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, London Telex," Telex: 2-3039.

BRANCH OFFICES: 7, John Bright Street, Birmingham, 1. Telephone: Midland 4117-8. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AUCTIONS

ESTABLISHED 1855.
EDWARD RUSHTON, SON AND KENYON,
INDUSTRIAL VALUERS, AUCTIONEERS AND
FIRE LOSS ASSESSORS.
12 YORK STREET,
MANCHESTER, 2.
Phone, Central 1937–8.
Grams, Russonken, Manchester. zzz-0304

AUCTION MARCH 19.—Valuable Freehold Wharfage Property, Cubitt Town, E.14. Good frontage to Thames. Useful buildings, covered floor area 75,000 sq. ft. and Yard space of 5,000 sq. ft. Good loading—electric crane. Particulars—Chamberlain & Willows, 23 Moorgate, E.C.2. Phone MET 8001 (8 lines). 234-9

AUCTION MARCH 19, at the City Auction Hall, 58 Coleman St., W.C.2, at 4 p.m. Two Freehold Modern Factories—at Edmonton—Single floors. Areas 15,400 sq. ft. and 9,000 sq. ft. respectively—to be offered with Vacant Possession in two lots. Particulars and conditions from Chamberlain & Willows, Auctioneers, 23 Moorgate, London, E.C.2. Phone MET 8001. 234-10

BUSINESS OPPORTUNITIES

WANTED TO PURCHASE.

THE MARLEY TILE COMPANY, LIMITED,

IS INTERESTED IN PURCHASING

A BUSINESS WITH GOOD MANUFACTURING

FACILITIES OF PLASTICS PRODUCTS.

MUST HAVE POSSIBILITIES FOR EXPANSION.

COMMUNICATE IN CONFIDENCE TO:—

THE MANAGING DIRECTOR,

THE MARLEY TILE COMPANY, LIMITED,

RIVERHEAD,

SEVENOAKS, KENT.

239-5324

BUSINESS OFFICES AND PREMISES

SUCCESSFUL LIGHT MANUFACTURING CONCERN with excellent goodwill and sound assets including Freehold London Factory of 13,500 sq. ft., interested in hearing from energetic and ambitious person or firm who would invest up to £10,000 for share in present and/or additional manufacturing business. Ground floor of 5,000 sq. ft. could be made available. Box P3418, care of "Plastics." 234-x4615

DECORATIVE METALLIC SPRAYING, London. Lease and complete plant for disposal at £1,200 o.n.o. Full particulars Box P3423, care of "Plastics." 234-41

Business Offices and Premises (cont.)

MODERN well equipped single storey factory complete with offices, open yard and w.c.s for both sexes. Hackney, E.8. Area about 2,200 sq. ft. Equipment about £11,000. Producing plastic jewellery. To be let on lease. Rental £50 per week, exclusive. Apply Garrod & Henley, 1A Wickham Court Road, West Wickham, Kent. Springpark 2296/7/8. 234-53

BUSINESS OFFICES AND PREMISES WANTED

WANTED TO PURCHASE, small company, active or inactive, in the P.V.C. coating, converting, chemical or allied trades, with tax losses £10,000 to £30,000. Replies treated in strict confidence. Box P342, care of "Plastics." 234-35

CONSULTANTS

DESIGNS, ideas, detailed drawings for new plastic products. W. Bruce Brown, M.S.I.A., F.R.S.A., industrial designer, 140 Roding Rd., Loughton, Essex. Loughton 4138. 235-5277

TECHNICAL DIRECTOR of company specializing in electro-plating plastics, particularly barrel plating, offers services as consultant to firms wishing to install this process. Box P3422, care of "Plastics." 234-45

DESIGN AND DRAWING

DESIGN AND DRAUGHTING SERVICES. We specialize in particular, in Moulds for Plastics, Compression, Transfer and Injection, also jigs and fixtures. We offer a reliable, speedy and confidential service. Spotona Ltd., Watchett Works, Oakhurst Rd., Southend-on-Sea, Essex. 222-115

PLASTICS MOULD DESIGN: Injection, Compression, Transfer. Competitive charges and deliveries. Product design and styling. Also Jigs, Tools, Fixtures, etc. D. & H. Designs Ltd., 265, Finchley Rd., London, N.W.3. HAMpstead 6656. 234-52

MACHINERY, TOOLS AND PLANT

HYDRAULIC. Frazer mono-radial pumps, new and secondhand, in stock. Thompson & Son (Millwall), Ltd., Cuba Street, London, E.14. East 1844. zzz-119

Six Unused Horizontal Three Throw Hydraulic Pumps, 3 in. ram × 9 in. stroke, capacity of each pump 50 gallons per minute, crankshaft speed 75 r.p.m., 2,240 lb. pressure, with 110 h.p. Slip Ring Motor and Starter.

Six Unused Weight Loaded Type Hydraulic Accumulators, 10 in. ram × 12 ft. stroke, capacity 35 gallons each, pressure 2,240 lb. per square inch, with 70 tons ballast weights and valve gear.

All made by The East Ferry Crane and Engineering Co., London.

JOHN CASHMORE LIMITED,
GREAT BRIDGE,
STAFFS.
Phone: Tipton 2181/5. 234-5273

INJECTION NOZZLES. For all machines. Prompt delivery including specials. Euco Tools, 44 London Rd., Kingston, Surrey. 222-125

PLASTICS MACHINERY
Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.
Send your requirements to the specialists.
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
CUBA STREET, MILLWALL, E.14.
Phone, East 4081 (five lines). 234-51

Machinery, Tools and Plant (contd.)

HUPFIELD 1 OZ. Series 2A Windsor SH-3, Nene Valley 1 oz. Air Operated for sale. Can all be seen working. Box P3416, care of "Plastics." 234-x4761

TWO hand Injection Moulding Machines for sale. £100 the two. Quick sale. Midland. Box P346, care of "Plastics." 236-5321

WINDSOR S.H.4. 4 oz. fully automatic Injection Moulding machine for sale. Can be seen working by appointment. Stewart Plastics Limited, Purley Way, Croydon, Surrey. 234-22

INJECTION MOULDING MACHINE. One 4 oz. semi-automatic PECO for sale. In very good condition. Can be seen working by appointment. Stewart Plastics Limited, Purley Way, Croydon, Surrey. 234-21

1,200-ton double acting Press by Fielding & Platt. Downstroking glanded Ram 26 in. diam. × 27 in. stroke and upstroking Ram 24 in. diam. × 26 in. stroke, both at 5,000 lb. sq. in. pressure. Four columns 10 in. diam., distances between 62 in. × 26 in. Fully guided moving and stationary tables each 5 ft. diam. with daylight 45 in.

500-ton Downstroke Press by Hydraulic Eng. Co. Ram 18 in. diam. × 30 in. stroke. WP. 2 tons sq. in. Four 7 in. diam. columns, distances between 54 in. × 24 in. Fully guided moving table, working area 54 in. × 42 in., is returned by two 5 in. diam. Pushback Rams. Daylight 40 in. Below press base a double acting hydraulic Ejector with load of 30 tons at 1,500 lb. sq. in.

400-ton UPSTROKE PRESS by Greenwood & Batley. Ram 16 in. diam. × 28 in. stroke. W.P. 2 tons sq. in. Four columns 5 in. diam., distance between 22 in. × 17½ in. With 9 steam heated platens 36 in. × 17 in. giving 8 daylights 2⅛ in.

400-ton Fielding & Platt Downstroke Concrete Slab and Kerb PRESS. Prefilling ram 23 in. diam. with 4 in. pullback. Two columns 8 in. diam. × 56 in. between. W.P. 1 ton sq. in.

Four 400-ton Upstroke Presses by Greenwood & Batley. Glanded ram 16 in. diam. × 30 in. stroke. Four screwed columns 5½ in. diam., distances between 22 in. × 17½ in. Moving table, working area 3 ft. × 17 in. Daylight 42 in. W.P. 2 tons sq. in.

300-ton Downstroke PRESS by M. B. Wild. 20 in. diam. Ram × 48 in. stroke. Four columns 6 in. diam., distances between 36 in. × 23 in. Fully guided table, working space 36 in. × 28 in. Daylight 5 ft. W.P. 1 ton sq. in.

250-ton UPSTROKE PRESS. Ram 18 in. diam. × 15 in. stroke. W.P. 1 ton sq. in. Four columns 5¼ in. diam., distance between 22½ in. × 18 in. Semi-guided tee slotted table 30 in. × 14 in. × 9½ in. deep, daylight 14½ in.

Four 150-ton Upstroke Hydraulic PRESSES by Wild. Ram 17 in. diam. × 18 in. stroke. W.P. 1,500 lb. Four 5 in. diam. columns, distances between 25 in. × 15½ in. Fully guided moving table, working area 29 in. × 25 in. Daylight 31 in. Table returned by two pushback rams.

140-ton UPSTROKE PRESS by Tangye. Main Ram 14 in. diam. × 21 in. stroke. W.P. 1 ton sq. in. Four Columns 5½ in. diam., distance between 18½ in. × 18½ in. Fully guided moving table, working area 24 in. × 18 in. for platens up to 20 in. sq. Daylight head to moving table, adjustable, 16 in.–29 in.

120-ton downstroke Hydraulic Press by Bradley & Turton. Ram 15 in. diam. × 18 in. stroke. W.P. 1,500 lb. sq. in. Four columns 3¾ in. diam., distances between 30½ in. × 14½ in. Fully guided moving table, working area 30 in. × 28½ in. Daylight 30 in. Table returned by pushback rams.

GEORGE COHEN, SONS & CO., LTD.,
WOOD LANE, LONDON, W.12.
Phone, Shepherds Bush 2070
AND
STANNINGLEY, NR. LEEDS.
Phone, Pudsey 2241 234-23

Machinery, Tools and Plant (contd.)

FOR SALE. Four Stainless Steel rotary fluid blenders motorized ½ h.p. 700 r.p.m. 400/440 v./3/50.
Twenty-four Infra-Red panel heaters, 2 ft. square, 4 kW., 200/250 V.
Enquiries:—R.N.I.B., Euston 5251. 234-2

TWO (2) Tomlinson Continuous band hot air drying machines, complete with four "Turblex" heating batteries, steam pressure 200 lbs. All electrical equipment and full instrumentation. Drying Chambers 42 ft. long, each fitted with perforated stainless steel band 36 in. effective width, and in excellent condition, specially designed for easy cleaning and fitted with wet wash automatic band cleaning device. Box P3412, care of "Plastics." 234-39

FOUR BOWL HIGH PRESSURE PLASTICS CALENDER. 42 in. wide bowls, one 13 in. and three 15 in. diam. By Farrell (U.S.A.). Complete with motor, reduction gear, helical drive, pyro bars, and four heavy copper cylinder drying range behind. Previously used on plastic floortiles. Details from: Hodson & Co. (Machinery) Ltd., Tottington, Bury, Lancs. 234-3

ONE ONLY. 25-ton Vertical Injection Press, complete with pushback rams and guards. In perfect working condition. Below.

ONE ONLY. 8-gallon 3-throw Bradley & Turton Pump. Fully motorized and in excellent working condition. Both the above items may be viewed in London. Box P3411, care of "Plastics." 234-40

MACHINERY, TOOLS AND PLANT WANTED

EXTRUDER AND VACUUM FORMING MACHINES wanted—send full details, Box P329, care of "Plastics." 237-5242

WANTED, secondhand or reconditioned Beken Mixer, 4 or 8 gallon working capacity. Full particulars (including vacuum details if any), price, etc. Box P3327, care of "Plastics." 234-5280

WANTED 3 oz. Injection Moulding Machine, good condition Windsor if possible, also redundant toy moulds. Full particulars Box P3417, care of "Plastics." 235-x4859

WANTED one Stainless Steel Jacketted Mixer, ½-gallon capacity, with Sigma type stainless steel blades, hand lever tilt and complete with 1 h.p. drive suitable for 400/440 V. 3-phase, 50-cycles supply. Below.

WANTED one set 36 in. × 14 in. approx. Mixing Mills. Steam heated and water-cooled rolls of chilled cast iron hard chrome plated. Complete with 40 h.p. drive suitable for 400/440 V. 3-phase, 50-cycles electrical supply. Write Development Engineer,
Lacrinoid Products Ltd., Stafford Ave., Gidea Park, Essex. 234-20

MISCELLANEOUS

ELECTRICAL HEATING. All types of electrical elements supplied. Apparatus repaired. Heaters designed. G. H. Taylor & Co., Meadow Rd., Netherfield, Notts. 236-5319

MOULDS

COMPRESSION MOULDS available for export, for production of Ashtrays, Cigarette Boxes, Household Articles, Fancy Goods, etc. Box P318, care of "Plastics." 237-05209

MOULDS WANTED

MOULDS WANTED. Send details of your surplus or redundant Injection and Compression Moulds. Box P3210, care of "Plastics." 237-5243

PRODUCTION CAPACITY AVAILABLE

INJECTION MOULDINGS AND PLASTIC COVERING IN ACETATE ALKATHENE, P.V.C. POLYSTYRENE AND DIAKON.
Machined Parts in Brass, Steel and Plastics.
We solicit your inquiries.
F. A. KETCH AND SON, LTD.,
TRENT VALLEY WORKS,
LICHFIELD, STAFFS.
Phone 3591 and 3592. zzz-500

SHORT RUNS A SPECIALITY, LONG RUNS A PLEASURE. Low mould cost and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, Temple Works, 41 Old Church Rd., Chingford, E.4. Silverthorn 7927. 235-1207

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. Phone 4059. 235-1208

Production Capacity Available (contd.)

VACUUM FORMED PLASTICS. Facilities for design development, fabricating and printing. B. T. Bennett & Co., 449 Alexandra Avenue, Harrow, Middx. Field End 6755. 236-1219

DINES PRODUCTS, Whitehall Lane, Grays, Essex, for injection mouldings. 235-1209

PLASTICS (MANCHESTER), LTD.,
BRITAIN'S LEADING STOCKISTS AND DISTRIBUTORS.
SPECIALISTS IN
FABRICATION, INJECTION MOULDING AND ENGRAVING.
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and Central 1000. zzz-308

NYLON, POLYSTYRENE AND ACETATE INJECTION MOULDINGS up to 2 oz. Reliable service. Latest-type machines. Keen co-operation on new lines. W. H. Adamson Plastics, Ltd., 39 Hedley St., Maidstone. 238-5278

VISIJAR LABORATORIES, LTD.
THE LEADING CRAFTSMEN IN "PERSPEX."
PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS "PERSPEX."
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF "FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (two lines) zzz-133

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 244-5276

TUBE LAMINATION AND ENGINEERING, LTD.
HIGH WYCOMBE,
BUCKS.
MAKERS OF S.R.B.P. TUBE "LAMTUF."
LIGHT ENGINEERS.
HIGH WYCOMBE 1921-2 zzz-312

CAPACITY AVAILABLE for various types of assembly. We are assembly specialists with skilled staff. Very competitive prices. Conti-Plastics Ltd., Trading Estate, Park Rd., High Barnet, Herts. Barnet 9345. 234-7

RAW MATERIAL

PLASTICS (MANCHESTER), LIMITED,
BRITAIN'S LEADING STOCKISTS
OF
PERSPEX SHEET, ROD, TUBE,
11 WHITWORTH STREET,
MANCHESTER, 1.
Central 7081-2 and 1000. zzz-309

RIGID P.V.C. SCRAP and in ground form for disposal in large quantities. Herbert Connor Ltd., 120 Beaufort Park, N.W.11. 234-27

P.V.C. SCRAP and offcuts for disposal—15 tons. Box P341, care of "Plastics." 234-26

REGROUND POLYSTYRENE from 1s. 4d. per lb. Herbert Connor Ltd., 120 Beaufort Park, N.W.11. 234-32

CLEAR POLYSTYRENE SCRAP for disposal in regular quantities. Box P344, care of "Plastics." 234-28

PEARL-ESSENCE, offers for Mother of Pearl Finish, R. C. Lovington, 189 Regent St., W.1. Phone Reg. 4191. 234-6

FOR DISPOSAL: 5 tons Brand New Ebonite and Casein Tubes and Rods, sizes .2 up to .6 diameter. Various colours. Apply Box P2614, care of "Plastics." 234-47

Raw Material (contd.)

CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd., 270 Corporation St., Birmingham. Central 5474. 234-49

FOR DISPOSAL: 2 tons Virgin Khaki and 3 tons Virgin Maroon Polystyrene Pellets. Apply Box P2613, care of "Plastics." 234-48

ALWAYS LARGE STOCKS OF
CASEIN
RODS, TUBES AND SHEETS.
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1.
Phone, Monarch 4686. 245-5323

LARGE QUANTITY OF COLOURED P.V.C. (paste) reject mouldings available. Virgin material phthalate plasticized, free from fillers and extenders. Highly suitable for compounds, extrusion, or flooring applications. Write V. & E. Plastics Ltd., 8 Gt. King St., Macclesfield, Ches. 234-12

RAW MATERIAL WANTED

SURPLUS STOCKS of thermosetting and thermoplastic moulding powders wanted. Send details. Box P311, care of "Plastics." zzz-227

ERLANOS, LTD., 93 Aldersgate St., E.C. (Monarch 4686), require Perspex and cellulose offcuts and scrap, clear and coloured; highest prices paid. 241-5177

POLYTHENE, POLYSTYRENE, DIAKON, ACETATE, P.V.C. SCRAP WANTED in lump, scrap, film, sheet, or reground form continuously. Please send samples and details to: Herbert Connor Ltd., 120 Beaufort Park, N.W.11. 234-31

POLYTHENE FILM urgently required. Highest prices paid. Box P348, care of "Plastics." 234-30

POLYTHENE SCRAP of all descriptions continuously wanted in large quantities; in any form. Please send details and samples to: Herbert Connor Ltd., 120 Beaufort Park, N.W.11. 234-29

WANTED, Polythene scrap. Write to Box P221, care of "Plastics." zzz-132

PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and backing. Box P312, care of "Plastics." zzz-131

P.V.C. GARMENT AND HANDBAG OFFCUTS wanted. We collect and pay cash. Brockwell Plastics, Ltd., 50 Hollingbourne Rd., S.E.24. zzz-130

THERMO PLASTICS SCRAP. We always buy large and small quantities and pay prompt Cash. Send offers to J. W. Nash & Co. Ltd., 27 Beethoven St., W.10. Ladbroke 4655/6/7. 234-55

WE REQUIRE large regular supplies of Nylon Scrap, Shavings, Lumps and Rejects. Box P332, care of "Plastics." 234-54

POLYSTYRENE SCRAP—regular buyers. Michael S. Stevens Ltd., Keswick Road, Putney, S.W.15. Vandyke 3345. 234-50

SITUATIONS VACANT

FOREMAN for night shift wanted. Knowledge of maintaining machines preferred (injection moulding). Good wages to right applicant. Box P3115, care of "Plastics." 234-46

BUSINESS AND TECHNICAL MANAGER required. Main products are machined parts and fabrications from Laminated materials, compression mouldings and forming of Thermo Plastics. Other activities under consideration. Applicants must have knowledge of the Trade, manufacturing methods and be able to conduct technical relations with customers and material suppliers. Knowledge estimating and costing desirable. Excellent prospects, Superannuation, London. Full details of experience, please, remuneration accordingly, Box P3419, care of "Plastics." 234-42

Situations Vacant (contd.)

PRODUCTION ENGINEER to take full responsibility for Department manufacturing Instrument Cases and Containers from Laminated Materials. Previous experience not expected, but ability to estimate, establish and maintain costs, also control staff essential. Excellent opportunity for man with Engineering and Fabrication background. Superannuation. Full details of past experience please, Box P3420, care of " Plastics." 234-43

AGENT REQUIRED, Commission basis, to represent capable moulders. Must have suitable connections, with buyers of mouldings. Exclusive and sole territory granted. Write Box P2914, care of " Plastics." 234-05144

TOOL ROOM WORKING FOREMAN required. Must have considerable experience of Plastic Mould work. Capable of supervising. Situation 30 miles London. Permanent and well paid position. After probationary period, satisfactory person will be given an interest in the business. Write Box P3111, care of " Plastics." 234-5207

TECHNICAL SALES REPRESENTATIVE required by small progressive compression and injection moulders. Box P3224, care of " Plastics." 234-5246

DESIGNER-DRAUGHTSMAN required, must have experience of Compression, Injection and Transfer Mould Tools. Permanent and progressive position with small firm 30 miles from London. Golden opportunity for one with the necessary qualifications. Send full details of experience and salary required. Box P3223, care of " Plastics." 237-5245

PLASTICS DRAUGHTSMAN with experience of injection mould design required by progressive Company in Wimbledon Area. Salary commensurate with age and previous experience. Pension Scheme and Canteen facilities available. Apply Box P338, care of " Plastics." 234-5274

FOREMAN REQUIRED for small compression moulding shop approximately 30 miles from London. Must be fully experienced. Permanent position. Write Box P339, care of " Plastics." 235-5275

APPLICATIONS INVITED for situation as Works Chemist in cable factory in London area. H.N.C. standard or equivalent. Shop experience of value also knowledge of compounding, colour matching and test procedures. Apply giving details of experience and salary required to Box P3326, care of " Plastics." 234-5279

A POSITION of responsibility is open to a Technical Sales Engineer with experience of installations of hydraulic circuits in industrial applications. This important company has an established reputation in aircraft hydraulics and is now expanding its production to the industrial field. The position offers great scope to the right man. Write in full confidence giving details of past experience to Box P3410, care of " Plastics." 234-24

A TECHNICAL SALES REPRESENTATIVE between 23 and 26 years of age is required to join an expanding company of Chemical Manufacturers in Lancashire, supplying raw materials to the Plastics, Rubber, Paint and Allied Trades.

A Technical Degree would be an advantage but is less important than real ability to play a full part in the activities of a small but dynamic sales force.

Duties after a period of training will include selling the company's products in England excluding Home Counties, expenses being provided.

A car will be available and remuneration will be by way of salary. Contributory Pension Scheme.

Applications giving full details, etc., to Box P347, care of " Plastics." 234-33

TECHNICIAN with complete knowledge of production and colouring of Urea Moulding Powders required for interesting project. Write Box P345, care of " Plastics." 234-34

ASSISTANT EXPORT MANAGER required to develop industrial rubber division of leading manufacturer. Rubber technology background important but not essential. Successful applicant will be based out of London, possibly in West Country and will be required to travel overseas. Write stating age, experience, qualifications and present salary to Box P343, care of " Plastics." 235-5322

PROMINENT AND PROGRESSIVE FIRM of Plastic Moulders and Extruders has opening for young Industrial Designer with ideas. Applicant should be in the 30's, keen and ambitious. House in new town available. Box P349, care of " Plastics." 234-25

SALES ENGINEER REQUIRED.—Must have a background of the complete field of Extrusion Engineering, embracing blown tubing, sheet, cable covering and piping, and, of course, the ability to sell. Good salary for the right man. Write in confidence giving full details of previous experience, etc., to N. Browne, Bone Brothers Ltd., Manor Farm Rd., Alperton, Wembley. 236-5320

PLASTIC MOULD DESIGNER DRAUGHTSMEN required for Thermo-Setting Moulding. Must be fully conversant with all types of mouldings and able to work with a minimum of supervision. For our Paddock Wood and Edmonton Factories. Five-day week. Write giving details of qualifications, age and salary expected to:—Insulators Ltd., Leopold Rd., Edmonton, N.18. 234-11

Situations Vacant (contd.)

CAPABLE MAN REQUIRED to take charge of Injection Moulding Dept. Experienced with Reed-Prentice machines and able to change tools and maintain presses an advantage. Particulars, giving experience, age, etc., to—V. & E. Plastics Ltd., 8 Gt. King St., Macclesfield, Ches. 234-13

TECHNICAL REPRESENTATIVES required. Main products are machined parts and fabrications from Laminated materials, compression mouldings and forming of Thermo-Plastics. Other activities under consideration. Substantial salary, commission, car, expenses, superannuation. Full details past experience please, Box P3421, care of " Plastics." 234-44

EXPERIENCED JIG MAKERS REQUIRED. Good wages, Pension Scheme and working conditions. Apply: Thermo-Plastics Ltd., Dunstable, Beds. 234-15

EXPERIENCED SALES REPRESENTATIVE required for Glass Reinforced Laminates. Ability to handle business at highest level essential. Apply: Thermo-Plastics Ltd., Luton Road Works, Dunstable, Beds. 234-14

DEVELOPMENT ENGINEER. Fibreglass Ltd., who are concerned with the manufacture and processing of glass fibres and whose works is situated in St. Helens, require a well qualified, graduate, mechanical or chemical engineer, preferably with experience in the Plastics industry. He will be required to take charge of a small section in the Development Department which is responsible for research and development on production techniques for Fibreglass reinforced plastics. The work will include full scale prototype moulding and technical service to customers, involving close collaboration with the Sales Department. Applicants, who should preferably be not more than 35 years of age, are invited to send details of their qualifications and experience to the Personnel Liaison Officer, Pilkington Brothers Ltd., St. Helens, Lancashire (of whom Fibreglass Ltd. is a Subsidiary Company). 234-16

ASHDOWNS LIMITED
ST. HELENS
HEAD OF PLASTICS TEST LABORATORY

ASHDOWNS LIMITED (Plastic Manufacturers), a subsidiary of Pilkington Brothers Limited, require an Honours Graduate in Physics to set-up and control a test laboratory for raw materials and finished goods. This is a new appointment and calls for an able and enthusiastic man prepared to develop new test methods as well as to review current procedure. The laboratory will have electrical, mechanical and chemical test sections to deal with all aspects of the Company's work. Applications from all age groups will be welcomed, but the preferred range is 27–33. Salary will be fixed by agreement and will be in accordance with the great importance which is attached to this situation. Applications should be made to the Personnel Liaison Officer, Pilkington Brothers Limited, St. Helens, Lancashire. 234-17

DEVELOPMENT PHYSICIST OR MECHANICAL ENGINEER. Graduate physicists or mechanical engineers, who are interested in the field of Fibreglass reinforced plastics, are invited to apply for a vacancy in the Development Department of Fibreglass Limited, St. Helens. The work will be primarily on the testing of mechanical properties of materials, and it would be an advantage if the applicant were conversant with techniques and equipment for specialized tests, including creep and fatigue. Applicants, who should preferably be not more than 35 years of age, are invited to send details of their qualifications and experience to the Personnel Liaison Officer, Pilkington Brothers Limited, St. Helens, Lancashire, of whom Fibreglass Limited is a Subsidiary Company, quoting:—Ref. F. 234-18

A TECHNICAL SALES REPRESENTATIVE is required by ASHDOWNS LIMITED, leading Plastics Manufacturers, whose Works is situated in St. Helens. The position is that of representative for Scotland and the north-east of England and entails the sale to industry of Fibreglass reinforced plastics, industrial laminates and thermo-plastics. The person appointed will be required to take up residence in Scotland. Applications are invited from men between 30 and 40 years of age, who have sound technical background in mechanical and electrical engineering, who are capable of reading technical drawings, who have a wide connection throughout the appropriate industries in the area, and possess the initiative, drive and capability of working on their own responsibility Experience in industrial plastics is an advantage but is not essential. Applicants are invited to send details of their education and experience to the Personnel Liaison Officer, Pilkington Brothers Limited, St. Helens, Lancashire, of whom Ashdowns Limited is a Subsidiary Company. 234-19

AEROPLASTICS LIMITED, Hillington, Glasgow, a subsidiary of The Fairey Aviation Co. Ltd., require a General Manager to take charge of their factory which manufactures high-grade plastics. The post, which has good prospects, requires a man with good technical and managerial background, preferably in the engineering or plastics industries. Applications, which will be treated in the strictest confidence, should state experience, age and salary required, and be addressed to:

The Secretary, Aeroplastics Limited, Hillington, Glasgow, S.W.2. 234-1

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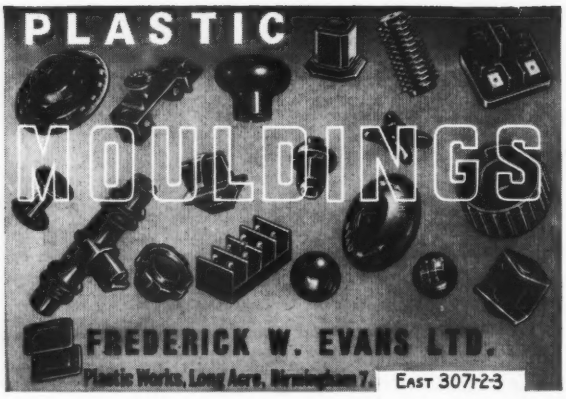

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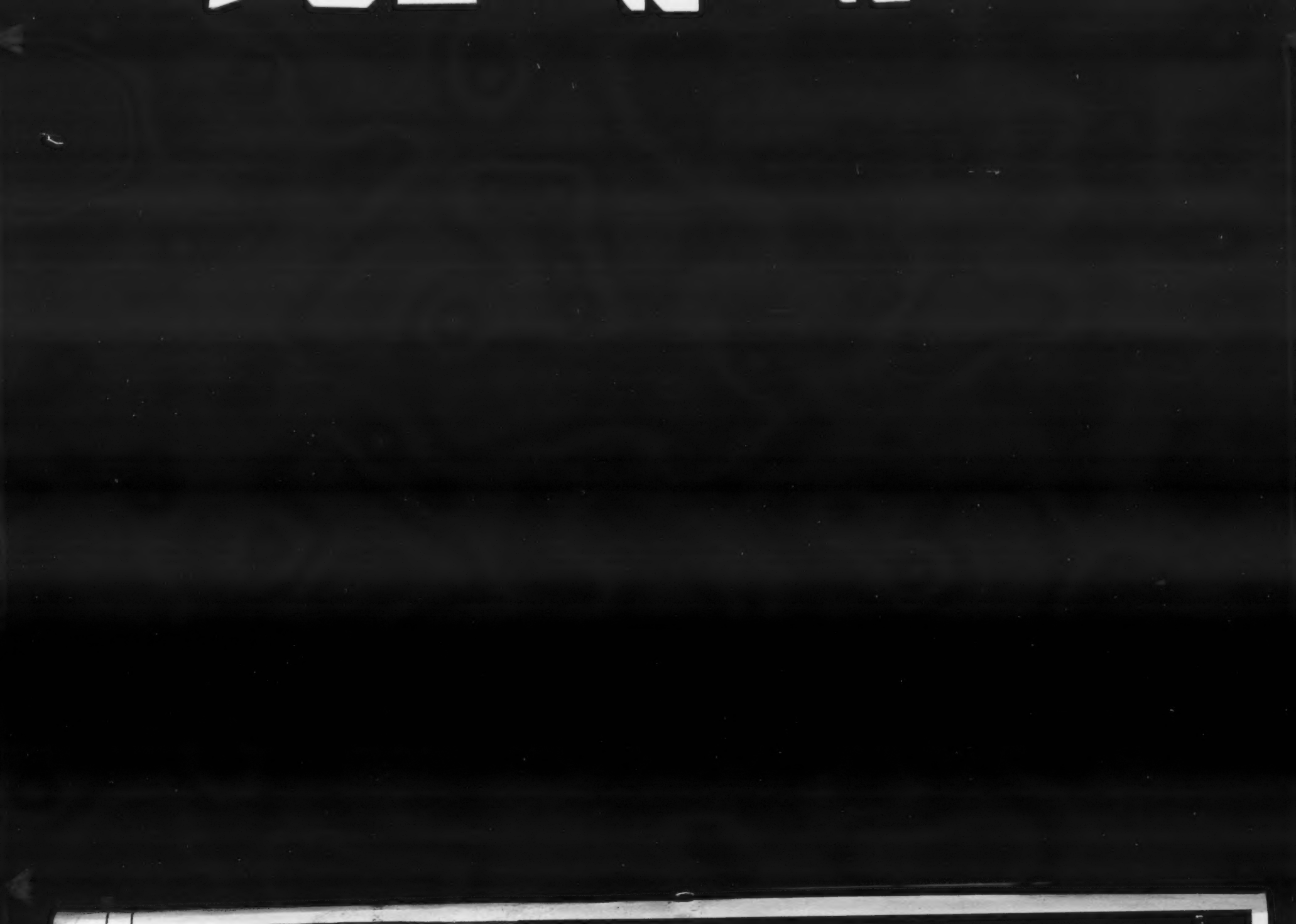
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